FORESTRY ABSTRACTS

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FORESTRY ABSTRACTS

VOLUME 4 1942 NUMBER 2

WOOD-WASTE UTILIZATION

I. THE CHEMICAL UTILIZATION OF WOOD WASTE*

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THE efficient utilization of otherwise unusable wood waste by some kind of chemical conversion represents an ideal which has so far proved impossible of attainment except under special circumstances. The obstacles in the path of the chemist in these days are constituted not so much by lack of knowledge of what wood can be made to yield in the way of useful products, but rather by human and economic factors which are beyond his control. To be successful, commercial chemical operations must be carried out on an adequate scale in an efficient plant which is well located in relation to power and transport facilities as well as to continuous supplies of uniform raw material and chemicals. In practice this means either that plant and chemicals must be taken to the source of the raw material or that both raw material and chemicals must be transported to centrally located plant. Herein lie the main economic factors to be considered in the chemical utilization of wood, and the position is further complicated by the fact that many of the products which can be obtained from wood by chemical processes are more readily obtainable at lower cost from other sources. It is therefore not possible to propound a scheme for the chemical utilization of wood waste which will be of universal application in all circumstances. The purpose of the present article is briefly to review the major chemical processes that can or might be applied to wood waste in order to yield utilizable products and, wherever possible, to cast some light on the general economics of the undertaking.

As a chemical raw material, wood waste may be considered in three categories as follows:—(1) branch and stump wood suitable for distillation, (2) slabs and offcuts suitable for conversion to pulping chips, and (3) sawdust shavings and planer chippings.

(1) BRANCH AND STUMP WOOD.

Destructive distillation was by far the earliest chemical conversion process to be applied to wood. In its crudest form it is applied to the production of charcoal in the primitive pit kiln. Charcoal production by this method can only be of economic importance when constant composition and properties in the product are not prime considerations, and this method is therefore applicable to the waste of any species. By the early part of the present century, however, wood distillation had become a highly specialized industry, softwoods being worked for charcoal, tar, and pitch, and hardwoods for charcoal and the valuable volatile products acetic acid, methanol or wood spirit, and acetone. Softwood waste rich in oleoresin has, in addition, been worked for turpentine by steam distillation and for rosin by solvent extraction [1].

The hardwood distillation industry was at one time the sole source of methanol, but the advent of synthetic processes for the manufacture of this important chemical dealt the industry a blow from which it is hardly likely to make a permanent recovery.

The economic success of wood distillation depends largely upon suitable markets for the charcoal, which is its major product. This explains why, when a demand for special types of charcoal arises, as it has in Great Britain during the present war, kilns are frequently designed for the purpose of making the required charcoal without considering the volatile products, which are allowed to escape.

(2) SLABS AND OFFCUTS.

Theoretically any form of waste wood which can be converted by hogging into suitable chips is potential raw material for pulp and paper manufacture, but it should be borne in mind that this highly organized industry is based on raw materials grown specially for its own purposes and, in normal times, as has been indicated in a recent Canadian Survey [2], many difficulties would have to be overcome before such forms of mill and factory waste as have been proved to be eminently suitable for pulping could be collected and incorporated as part of the raw material delivered to the pulp mills. Laying aside for the present these difficulties, which have been ascribed [2] to a 'lack of organized marketing and concerted action far more than to any purely technical difficulties', we may with profit examine very briefly certain modern trends in the chemical utilization of those forms of wood which are capable of conversion to pulping chips.

The object of all pulping operations is to break wood down into its ultimate fibres so that these latter may be reconstituted into sheets and boards and thereby enter the channels of utilization which are universally familiar. The cell-wall substance of wood consists of the three major components cellulose, hemicellulose and lignin, and in established chemical pulping processes such as the sulphite, soda and sulphate processes, the principal end product is cellulose, so that the lignin and much of the hemicellulose become waste products, which themselves

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present exceedingly complicated utilization problems. It is true that the sugars in waste sulphite liquors, for example, can be partially fermented to yield ethyl alcohol, that vanillin can be prepared from the lignin residues in the liquors, that the lignin itself can be used in certain forms of water purification, the manufacture of plastics and so forth, but each of these secondary processes requires organization and development. The advent of some entirely new process, which would at one and the same time produce cellulose in good yield and quality and usable products from the lignin in the raw material, would be a great step forward. Much interest may therefore soon be centred on the results of research of the type at present in progress in the U.S. Forest Products Laboratory, which indicate that hydrogenation of wood under suitable conditions [3] may be the means of bringing this about. It is already claimed that it is possible, on a small scale, to produce cellulose and to convert the non-cellulosic constituents of wood into alcohols, oils and resins in one operation.

In a recent review, Potter [4] has emphasized that, in the future, more and more wood cellulose will be used for purposes other than paper, such as the manufacture of viscose rayon and cellophane, to name only two examples, so that research on the most efficient methods of producing high-grade cellulose from wood can confidently be expected to continue. There are, however, other chemical and semi-chemical methods of pulping wood chips in which cellulose, as such, is not necessarily the primary end product. Two processes of this type will be referred to because they exemplify the most modern and efficient way to ensure almost complete chemical utilization of wood.

The Masonite Process.

The product known as 'Masonite' was invented in 1924 by William H. Mason at Laurel, Miss., U.S.A. The wood fibres of which it is composed are produced by a unique explosion process which can be controlled to produce pulp for some six different types of board. Recent research by the Masonite Corporation, which is described in an interesting article by J. A. Lee [5], indicates that the liquid effluent obtained in the production of Masonite is a valuable source of chemicals. Some 70 per cent. of the solids in this effluent are convertible to the sugars glucose, galactose, mannose, xylose and arabinose, and from the remaining 30 per cent., tars, fatty acids, waxes and resins can be derived. Methods have also been developed for the recovery of furfural, acetic and formic acids from the volatile by-products of the process and it was proposed in 1939 to erect a large plant to embody these various recovery processes in the complete Masonite process. Such is the scale upon which this process is operated that one mill produces 400,000,000 sq. ft. of board in a year and the potential output of sugars alone from its effluent amounts to 150,000 lb. per day. The total capacity of the five Masonite plants located in different parts of the world was stated in 1939 to be 582,500,000 sq. ft. of board.

The Asplund Defibrating Process.

This process was invented in 1932 by Arne Asplund, a Swedish engineer. It is carried out on various lignocellulose raw materials, including wood, and is based upon the discovery that, when heated to 160° to 180° C. in the presence of moisture, wood chips are softened and can be ground at these high temperatures to produce a highly defibrated product at a low power consumption. Yields of pulp of from 92 to 96 per cent. of the dry weight of the original material have been claimed for this process, which is well described in a recent article by Lowgren [6]. There is no doubt that in the Asplund process there exists one of the most efficient commercial methods for utilizing wood. In the article just quoted it is stated that about 60 per cent. of the 120,000 metric tons of wallboard produced in Sweden in 1939 was made from Asplund pulp and that in the United States 100,000 tons are now used annually in the roofing–flooring industry. It is also used in the manufacture of insulating and low-density board and bulk fibre. Some of the woods which have been used as raw materials in the Asplund process are Southern Yellow Pine, Jack Pine, Spruce, Hemlock, Californian Redwood, Aspen, Maple, Poplar and Oak.

When considering the utilization of wood waste which is widely dispersed in small lots, it is natural to think that, by minimizing transport costs, for example, it should be possible economically to convert it *in situ* into products such as building boards. To a certain extent this is being done at the present time. It is extremely doubtful, however, whether, in normal times, such local enterprises would be able to compete in the open market with the mass production of large plants operating processes such as those that have just been described. As Fellows [2] has said, 'it would be wise to regard any programme for the disposal of "waste" not as an end in itself, but rather as a stepping stone to better rationalization of production'. This means that so-called waste which cannot be collected in sufficient quantities and adapted to form part of the raw material of an efficient chemical process must be turned locally to any use, however humble, until such time as the whole process of wood conversion is rationalized so that waste, as such, can no longer exist.

(3) Sawdust, Shavings, etc.

This material represents wood waste in its most troublesome and abundant form. It is estimated, for example, that in Great Britain alone, sawdust is at present accumulating at the rate of at least 50,000 tons per annum. Despite a long list of uses for which sawdust in one form or another has been found invaluable, no single process has yet been discovered which will absorb this material continuously by the thousands of tons and turn out, economically, a series of useful products. During and immediately after the 1914–8 war a great deal of publicity was given to the fact that the carbohydrate components of sawdust can be hydrolyzed by means of acids to yield sugars and that these latter can be fermented with special yeasts to yield alcohol and other useful products. Large-scale processes such as those developed by Scholler and Bergius were used in Germany and are, it is believed, still being used there with the aid of Government subsidies, but, for reasons given elsewhere [7] the production of fermentable sugars from wood waste is never likely to be an economic proposition so long as the more usual sources of such products are available.

One of the drawbacks to the various processes for wood hydrolysis has been that by no means all of the wood

is converted to useful products. The Bergius process, for instance, involves a residue of lignin, and the dilute acid processes such as the Scholler process involve a much greater residue consisting of lignin and incompletely hydrolyzed carbohydrates. No market could be found to absorb the whole of this by-product. At one time it was thought that the product from dilute acid hydrolysis could be used as animal fodder, but exhaustive tests have shown that this is not so. In recent years, however, it has been found that partially hydrolyzed wood may find valuable application in the plastics industry. Intensive research at the U.S. Forest Products Laboratory [8] and elsewhere has shown that, when suitably compounded with other ingredients, hydrolyzed wood can be satisfactorily moulded under pressure, and products have been made which contain 85 per cent. of hydrolyzed wood. It has long been known, of course, that wood flour prepared from certain species is used in moulding compositions in conjunction with phenol-formaldehyde and other synthetic resins. Some such composites may contain as much as 50 per cent. by weight of wood flour, but there are indications that, if partially hydrolyzed instead of untreated wood flour is used in certain resinous moulding compositions, the proportion of synthetic resin employed can be reduced with consequent saving of chemicals like phenol and formaldehyde. A new interest, therefore, attaches to wood hydrolysis since a use may be found for all of the products including the solid residues. This subject is discussed in the recent article describing a new process based on a continuous principle for hydrolyzing wood under careful control [9], the sugars, etc., to be used as before and the solid products to be used in the manufacture of plastics.

Another use for sawdust, in which interest has been revived, is the manufacture of oxalic acid, and a detailed consideration of this process has also been published recently [10], but it is to be noted that none of these developments is likely to lead to the utilization of sawdust on a really large scale.

One of the most striking developments of the present war has been the way in which Sweden has been obliged to use the thousands of tons of chemical wood pulp which she is unable to export. By a modification of the sulphite process she is now able to obtain an increased yield of fuel alcohol from the sulphite waste liquors and animal fodder from the cellulose pulp. That cellulose is readily digestible by cattle, sheep and goats has been known since the latter part of the nineteenth century and this fact was exploited both in Germany and Sweden during the 1914–8 war. The developments in cellulose feeding which have taken place in Sweden since then are fully described in a paper by Edin [11]. The question naturally arises why cannot sawdust, especially during war-time, be transformed into a cellulosic fodder. Theoretically this is quite feasible provided the sawdust is substantially freed from the lignin which is itself indigestible and, because of its close association with cellulose in the wood cell wall, prevents the cellulose in raw sawdust from being digested. It will come as no surprise, therefore, that from an early stage in this war intensive research has been applied to the problem of delignifying sawdust on a large scale by a simple process which would yield animal fodder. For obvious reasons this work cannot be described in detail, but such is the present demand for fodder that, if the means were available to delignify all of the sawdust in the country, only a fraction of the total demand could thereby be met.

What has been said for the chemical utilization of sawdust applies in large measure to shavings and planer chippings. During the present paper-shortage it is often asked why sawdust cannot be converted into paper. The answer is that wood in this relatively fine state of division does not yield a fibre of sufficient length. In this respect shavings and chippings are more advantageous and a considerable bulk of this type of waste is to-day being used in conjunction with cereal straw for paper manufacture.

In an article of this type it is not possible to present more than a general picture, so that some aspects of this complex subject have had to be omitted if only for the sake of brevity. The following references to current literature, however, should enable any reader to obtain more detailed information on specific processes.

REFERENCES

[1] Hawley, L. F. Wood distillation. p. 125 *et seq.* Chem. Catalog Co., New York, 1923.

[2] Fellows, E. S. The preparation and marketing of Spruce sawmill 'waste' for chemical pulp chips in Quebec and Maritime Provinces. Dept. of Mines and Resources, Ottawa, Canada. 1940.

[3] Harris, E. E., and Sherrard, E. C. Simultaneous production of wood pulp and the conversion of the non-cellulosic constituents of wood into alcohols, oils and resins. U.S. Forest Products Laboratory, Madison, Wis. Mimeographed Report, 1940.

[4] Potter, G. J. C. Cellulose and other chemical products from wood (excluding paper). Dept. of Mines and Resources, Ottawa, Canada. 1939.

[5] Lee, J. A. New products from wood. *Chem. metall. Engng.* 47, 1940 (95).

[6] Lowgren, U. Asplund defibrating process. *Paper Tr. J.* 113, 1941 (Tappi Sect. 119–22).

[7] Campbell, W. G. The production of sugar, alcohol and other products from wood. *Chem. Ind., Lond.* 60, 1941 (47).

[8] Sherrard, E. C., Beglinger, E., and Hohf, J. P. Wood plastics as developed at the Forest Products Laboratory and their future importance. U.S. Forest Products Laboratory, Madison, Wis. Mimeographed Report, 1939.

[9] Katzea, R., and Othmer, D. F. Wood hydrolysis. A continuous process. *Industr. Engng. Chem.* (*Industr. ed.*) 34, 1942 (314).

[10] Othmer, D. F., Gamer, C. A., and Jacobs, J. J. Oxalic acid from sawdust. Optimum conditions of manufacture. *Industr. Engng. Chem.* (*Industr. ed.*) 34, 1942 (262).

Othmer, D. F., Jacobs, J. J., and Pabst, A. C. Oxalic acid from sawdust. Continuous fusion process. *Industr. Engng. Chem.* (*Industr. ed.*) 34, 1942 (268).

Othmer, D. F., and Royer, R. H. Oxalic acid from sawdust. Recovery of products resulting from treatment of wood with caustic. *Industr. Engng. Chem.* (*Industr. ed.*) 34, 1942 (274).

[11] Edin, H. The qualification of chemical pulp for use as fodder. *Svensk PappTidn.* 43, 1940 (145–151).

II. THE UTILIZATION OF SAWDUST AND SHAVINGS*

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THOUGH sawdust has many industrial uses, present-day utilization is difficult. Not only does most of this waste differ from pre-war material, but a number of outlets no longer exist, or the amount required has been greatly reduced. In peace-time, fairly large quantities were consumed in the aggregate. The requirements were chiefly for clean, dry sawdust, and in some cases certain grades of fineness and origin from a particular timber were specified. The material was obtained usually from seasoned or partly seasoned timber imported to this country in the sawn form, and was, therefore, free from bark and in a fairly dry condition (under 20 per cent. moisture content). Sawdust of this description is still being made to a limited extent and, where mills are favourably situated, is consumed locally. Failing local outlets, potentially useful sawdust has often to be burned or dumped, for transport of such bulky material is both costly and troublesome. The exception may be where a specific sawdust, e.g. that from Beech, is needed for a particular purpose and has to be collected at some distance from the place of consumption. The greater proportion of sawdust now being produced in Great Britain is from the conversion of home-grown timber and is fairly damp (50–100 per cent. moisture content), includes bark, and often consists of a mixture of species. There are few uses for such waste apart from a small consumption for floor sweeping and the protection of freshly-laid concrete. It can be used as a fuel in special furnaces, but its calorific value is low on account of the high moisture content. The possibility of finding other uses is increased, of course, if bark can be removed from the logs before conversion and the species kept separate. The drying of damp sawdust is not an economical proposition, owing to the special plant and great amount of heat required, and is found to be worth while only in exceptional cases.

Shavings and chips from planing, turning or other machine and hand operations, are usually produced from seasoned timber, and are, therefore, reasonably dry. They form a satisfactory fuel, provided the firing arrangements are suitable, and their other uses are mainly for packing and animal bedding. In previous years, many manufacturers installed grinding mills of the swing-hammer type to break down their chips into grade 'sawdust', for which there was a steady demand in various industries. It is doubtful whether such conversion is profitable under present conditions, as the cost in power is high and there are fewer outlets for this class of material.

The chemical utilization of wood waste has been discussed in the preceding paper and the present article is concerned with the various physical uses for sawdust and shavings as detailed below. Mention may be made here of one chemical aspect—destructive distillation as applied to these materials. Charcoal and the by-products of carbonization can be obtained from wood in this form, but economic production is only possible if carried out on a very large scale. Plant of special design is needed and the most favourable conditions, including an abundant local supply of raw material, are essential. The finely divided charcoal so produced requires in most cases further processing before it can be put to use. In one process, the charcoal is mixed with coal-tar pitch as a binder and pressed into briquettes which, subsequently, are stoved to remove the lighter fractions of the tar.

FUEL.

(i) *Raw material.*

The best method for the disposal of sawdust and shavings is usually as fuel for heating or power purposes. Utilization in this manner must take place at the mill or factory where the material is produced, for the use of transport is bound to be uneconomic. As a fuel, wood waste has the disadvantages of a fairly low calorific value[†] owing to the presence of moisture, a light weight in relation to its bulk, and possible trouble in flues through the escape of tarry gases when combustion is incomplete. Special furnaces are needed for efficient burning of sawdust and shavings, but ordinary boiler furnaces can be used if the material is burned in conjunction with a solid fuel such as coal. The latter must be fed to the back of the grate and the waste in front, so that the gas from the wood can burn in the space above the glowing coal. Wood burns with a considerable amount of flame and, if used as the sole fuel, there must be adequate combustion space and good air control to prevent a proportion of the gases burning in the wrong place or failing to burn and being lost. It is customary, therefore, to fit boilers with a Dutch oven extension, a stepped-grate furnace or a special arrangement for burning the fuel in suspension when chips and sawdust are employed. For domestic heating in Canada and the United States, sawdust is burned usually in stoves consisting of a hopper, sloping feed plate, stepped grate and combustion chamber, the latter being incorporated in some designs with the water heater or cooking oven. Further information on methods of burning sawdust is given in a recent article [16].

When the waste cannot be employed usefully as fuel or for other purposes, it is sometimes disposed of by means of an incinerator. There are various designs available on the market, but with the present shortage of metal, interest has been directed to burners of brick construction. Experiments have been made at the Laboratory (Princes Risborough) with two types:—(*a*) a simple form consisting of a circular brick wall having at the base a

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† Let m = moisture content (percentage based on dry weight of the wood), l = latent heat of evaporation of 1 lb. of water = 966 B.Th.U., c = average calorific value of 1 lb. of dry wood = 8,000 B.Th.U., then 1 lb. of wet wood contains $\frac{100}{100+m}$ lb. of dry wood and $\frac{m}{100+m}$ lb. of water.

Calorific value of 1 lb. of wet wood $= \frac{100}{100+m} \cdot c - \frac{m}{100+m} \cdot l = \frac{800{,}000 - 966\,m}{100+m}$ B.Th.U.

number of air inlets below an arrangement of firebars, and a cover and flue; (*b*) a combination of fuel hopper and furnace of rectangular section, with a central arch of metal or fire-brick, which provides for gravity feeding and pre-drying of the sawdust. Incineration of the waste at its source has the advantage of avoiding unsightly dumps that are wasteful of space or the cost of cartage away from the mill. The ashes have some value as a fertilizer as they contain a small amount of potash.

Shavings and solid wood waste are often used as fuel in gas producers for power purposes, and a certain amount of sawdust may be included. The latter is seldom used alone, as it is likely to cause trouble through arching or irregular burning in the generator. Small quantities of the finer dust tend to pass over with the gas and may clog the pipes leading to the gas-cooling and cleaning apparatus. Special forms of producer have been designed in the past for operation solely with sawdust, but few appear to have been really successful. It is the usual practice where sawdust has to be employed in ordinary types of gas producer to mix it with planer, hammer-mill or hogged chips. A mixture of two parts of the latter with about one part of sawdust is reported to give satisfactory results, but a greater proportion of sawdust may be used in certain types of plant.

(ii) *Fuel briquettes.*

Another method of utilizing the waste is in the form of fuel briquettes. They can be made in the presses used for coal-dust briquetting, under medium pressure, from a mixture of sawdust or shavings and a binding agent such as coal-tar pitch, waste sulphite liquors or petroleum residues, a fairly high proportion of binder being required. The plant is not unduly elaborate but a special drier is needed for dealing with damp waste, and an abundant supply of cheap binder is essential for success. The briquettes have the disadvantage of usually producing a considerable amount of smoke in burning, especially when pitch is the binder, and stoving subsequent to pressing is considered necessary if the briquettes are intended for domestic heating. Hitherto, wood-waste briquettes have not been able to compete with coal or even coal-dust briquettes in this country. At the present time, difficulty in obtaining a suitable supply of binder, not to mention the machinery required, is likely to prevent development. The high pressure method of making briquettes, in which a binder is unnecessary, is employed in America, chiefly in the western States, where the briquetting of sawdust has met with considerable success. Production has to be carried out on a very large scale, requires elaborate, costly plant and would not be practicable in Great Britain under existing conditions.

(iii) *Fire-lighter briquettes.*

The manufacture of fire-lighter briquettes from sawdust and shavings is a more satisfactory proposition, but the amount of waste absorbed is not large. Some forms of wood meal are used with various other ingredients, but ordinary dry sawdust mixed with petroleum residue or melted naphthalene can be made into satisfactory lighters by a simple process. Any expansion of this outlet would depend on the supply of inflammable binder available.

(iv) *Food curing.*

A further use as fuel, but in relatively small quantities, is for the curing of fish, bacon and ham. Sawdust and shavings, not necessarily dry, from Oak, Beech, Elm and Scots Pine are required for the purpose.

Gas Purification.

A mixture of lime, iron oxide and sawdust, sometimes with shavings, is used for gas purification. Sawdust does not itself absorb the impurities to any extent, but is added to render the mixture porous. It should not be moist, but partly seasoned material is accepted. Peat is preferred when available, as it is also an active agent in absorbing ammonia and other by-products. Increased use has been made of sawdust, and in war-time it can compete with peat, especially when produced near the gas works.

Wood-cement.

Sawdust has been used with a certain amount of success as an aggregate in pre-cast concrete units for building purposes. The cast or pressed material is light and has fairly good insulating properties. It can be nailed or screwed, and worked with ordinary woodworking tools, though naturally the blunting effect on their cutting edges is fairly severe. Wood-cement has a high initial shrinkage on drying and subsequent high dimensional changes on wetting and drying. This behaviour may induce one or more of three defects, i.e. warping during or after maturing, cracking while maturing, or cracking when in use because of rigid fixing methods. For building purposes, therefore, the material should be employed like timber, in units jointed so that they are free to move, as otherwise failure is certain. Reinforcement of wood-cement with steel is not economic, but, in certain circumstances, satisfactory results have been obtained with wood laths. Some improvement has been gained in the use of this material by control of drying in the early stages, and by careful design as regards dimensions of the units. Various pre-cast products, besides those for building, have been made from wood-cement and from plaster and sawdust. Hardwood dust of various grades and in some cases a mixture of hardwood and softwood dusts were used with magnesium oxychloride for composition flooring before the war. Sawdust is also the filler in some gypsum products, including plasterboards.

Absorbent.

Dry shavings and sawdust make good material for bedding in stables, cow-sheds and kennels. When available, Pitch-Pine waste is preferred for the latter purpose, as it is reputed to be a vermin deterrent. Non-resinous dry sawdust is a good absorbent and is used in butchers' shops, slaughter houses, markets, etc., for currying animals, oil extraction in factories and many other similar purposes. Sawdust impregnated with creosote is now being used on the floors of public shelters.

Cleaning Agent.

Quite a considerable quantity of dry Beech sawdust, in grades of 16 mesh and finer, was consumed before the war in the fur industry, but the present demand is small. Sawdust is required for cleaning, drying or polishing in the manufacture of numerous metal products, including tubing, sheet metal, wire-work, pins, &c. The specified grades range from coarse sawdust to fine meal or flour, the latter being produced from ordinary sawdust by sifting or by grinding shavings and other wood waste in hammer mills, the finer flour being obtained usually by grinding sawdust in abrasion mills. Wood meal is used to some extent in the electro-plating and jewellery trades, and is specified under three grades:—(1) fine, averaging 60 per cent. of 30–60 mesh with up to 20 per cent. of 100 mesh; (2) medium, averaging 40 per cent. of 30–60 mesh and 40 per cent. of up to 30 mesh; (3) coarse, averaging 50–60 per cent. of 20 mesh or under and about 10 per cent. of less than 60 mesh. The grades required depend on the size and nature of the article. Box and Beech meal is preferred for jewellery, Douglas Fir and Hemlock for brass and electro-plating, but other woods that are free from resin and chemically inactive may be accepted; the moisture content should be between 5 and 10 per cent. The material is used chiefly in tumbling barrels, but in some cases the cleaning operation is carried out in heated trays.

Packing.

Shavings and sawdust are well suited for packing all kinds of products, e.g. glass, china and metal ware, liquid containers, canned goods, instruments, fragile articles, etc. They have the advantages of cheapness, light weight, ability to absorb liquids if containers break and, owing to good insulation properties, to prevent liquids from freezing. Clean, dry material is required and, especially in the packing of metal articles, it must be free from corrosive volatile acids. Certain species of wood contain sufficient acid to cause corrosion of metals even under dry conditions and, on this account, sawdust from Oak, Sweet Chestnut and Western Red Cedar, for example, should be avoided for packing ferrous metals and lead.

Insulation.

Dry sawdust, sometimes in admixture with shavings, is used as heat insulation in floors and partition walls, cold stores, ice chests and refrigerators, and for lagging of hot water tanks and water pipes.

Production of Wood Meal and Flour.

Wood flour is produced from sawdust, planer chips and other wood waste. It can be manufactured by various types of machine—abrasion or stone mills, steel burr-roller mills and hammer mills. The abrasion mill consists of two grinding stones made from suitable abrasive material, one stationary and the other revolving, enclosed in metal casing. The material to be ground is introduced through an opening at the middle of the fixed stone and after reduction passes out at the periphery. The flour is then drawn or blown to the collecting and screening plant, rejected material being returned to the mill for re-grinding. The burr-roller mill is not used to any extent for wood-flour production. It has several pairs of serrated steel rollers, each succeeding pair having teeth of diminishing size. The two rollers revolve in opposite directions at different speeds and are set closely together. The material is fed to the coarsest tooth rollers and the ground product is treated in the same way as that from the stone mill. The hammer or impact machine has a number of hard steel hammers, either fixed or pivoted to a disc on a revolving shaft, which beat the wood waste against projections on the casing. A screen of suitable mesh, partly surrounding the hammer assembly, is used in separating flour coarser than 60 mesh, while an air current is drawn through the beating chamber to carry away the finer dust. The size of particle collected can be controlled by the speed of the air. It is necessary to employ hammer mills for breaking down chips and the larger wood waste into a coarse meal of about 8 mesh before grinding into flour in stone mills. The latter are only suitable for dealing with this form of material or sawdust. The waste has to be reasonably dry before grinding in a hammer mill for damp flour is troublesome to collect and screen. Considerable heat is generated in stone mills, however, and almost dry flour is produced if the raw sawdust contains less than 25 per cent. moisture. The best grades of wood flour are made in the stone mill, though the more 'fibrous' product from the hammer mill is well suited to a number of uses.

Many industries use wood flour, and in some cases the requirements as to grade, colour, species of wood, purity and moisture content are fairly exacting. Usually the moisture content must not exceed about 5 per cent., and light colour is specified where the material is employed as a dyed filler, for example, in the manufacture of linoleum and in the plastic industries. Flour from Pine and Spruce is used chiefly for plastics, the resin content being restricted in general to 1 per cent. Douglas Fir and Teak flour are preferred for plastic electrical goods. Hardwood flour is needed for various special purposes and a particular wood may be specified, such as Beech, Birch, Oak, Ash or Mahogany. Other uses for flour or meal are in the manufacture of explosives, dry batteries, incrusted wallpaper, roofing felt, composition flooring, polishing and grease-removing compounds, disinfectant powders and toys. It is also used for packing purposes and for firing clay products to give porosity, though flour and fine sawdust are now being replaced by special 'foamers'. Various grades of the meal are consumed in the electro-plating and jewellery trades as previously mentioned, and in the manufacture of aluminium sheet, tin plate and other metal products.

BIBLIOGRAPHY

[1] An improved composition for the manufacture of floor, wall and/or roof tiles. *British Patent* No. 439,273, 1936.
[2] An improved plastic self-hardening composition. *British Patent* No. 480,881, 1938.
[3] Apparatus for combustion and heating. *British Patent* No. 266,351, 1927.
[4] Beecher, H. W., and Watt, R. D. Combustion of waste wood products. (Paper presented to American Society of Mech. Engineers, September 1940.) *Engineering* 150, 1940 (474).
[5] Benson, H. K. Chemical utilization of wood. Twenty-second Report of the National Committee of Wood Utilization. U.S. Department of Commerce, Washington, 1932.

[6] BOAS, J. H. Wood-waste. *Bull. Coun. sci. industr. Res. Aust.* No. 19, 1921. pp. 82.
[7] Briquetting of sawdust. *Timb. Tr. J.* Nov. 24, 1928 (XXXIII).
[8] Briquetting of wood waste. Forest Products Laboratory, Madison, Wis. *Mimeo.* No. *R*842, 1939.
[9] Building material prepared from a mixture of sawdust or sawmill waste, with cement and calcium oxychloride, with or without the addition of trass or powdered brick. *British Patent* No. 269,845, 1927.
[10] DAHL, W. S. Wood flour. *Wood* 2, 1937 (357).
[11] Development in wood technology. *Engineering* 150, 1940 (461).
[12] FRIEDLANDER, C. J. Wood flour from wood waste. *Timb. Tr. J.* 134, 1936 (XIX).
[13] —— Wood waste and wood flour. *Wood* 2, 1937 (296).
[14] GILLHAM, R. B. The utilization of wood refuse for steam raising. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1. 1942. pp. 12.
[15] GRAF, S. H., and JOHNSON, R. H. The properties of cement-sawdust mortars, plain and with various admixtures. *Bull. Ore. agric. Engng. Exp. Sta.* No. 3, 1930.
[16] HARRIS, P. Burning sawdust. *Wood* 7, 1942 (70–2).
[17] HUBBARD, E. The utilization of wood-waste. Scott, Greenwood & Son, London, 1920.
[18] Improvements in and relating to furnaces. *British Patent* No. 371,998, 1932.
[19] Improvements in or relating to concretes or plastic masses comprising cement and sawdust. *British Patent* No. 321,744, 1930.
[20] Improvements in or relating to incinerators and the like. *British Patent* No. 382,039, 1932.
[21] Improvements in or relating to the destruction of comminuted material. *British Patent* No. 495,720, 1938.
[22] Improvements in processes of mineralizing fibrous materials, particularly sawdust, and in fibre and cement bodies or compositions. *British Patent* No. 225,912, 1924.
[23] Improvements in saw-dust burning stoves. *British Patent* No. 182,362, 1922.
[24] Improvements in stoves for burning sawdust and like residues. *British Patent* No. 197,325, 1923.
[25] Improvements relating to slow combustion heating stoves. *British Patent* No. 271,733, 1927.
[26] JENKINS, J. H., and GUERNSEY, F. W. The utilization of sawmill waste and sawdust for fuel. *Circ. Dom. For. Serv.* No. 48, 1937. pp. 15.
[27] KREISINGER, H. Combustion of wood-waste fuels. *Mech. Engng.* 61, 1939 (115–21).
[28] MAUNG KANTAYA. Utilization of sawdust as fuel for cooking purposes. *Indian For.* 49, 1923 (22).
[29] PORTER, H. A. Profitable utilization of wood waste. *Timberman*, June, 1927 (178, 180, 182).
[30] Process for treating organic fibrous materials for the manufacture of light-weight concrete. *British Patent* No. 480,740, 1938.
[31] Sawdust, wood flour, shavings, and excelsior. A treatise, supplementing the Committee's bulletin 'Sawdust and wood flour'. 6th Edition. National Committee on Wood Utilization, Department of Commerce, Washington, D.C. As issued by the Timber Development Association, Ltd., 75, Cannon Street, London, E.C.4. 1941. pp. 13.
[32] Sawdust concrete. Department of Scientific and Industrial Research, Building Research Station, Garston, Herts. June, 1941.
[33] SOEHNER, X. Power production from tropical vegetable waste. *Engineering* 143, 1937 (569–72, 599–600).
[34] SPRAGUE, J. C. Characteristics of sawdust concrete. *Civ. Engng., Lond.* 9, 1939 (316).
[35] STEIDLE, H. H. Wood flour industry. *Timberman*, July 1930 (172–74).
[36] STEVENS, W. C., and STEEL, E. A. Drying sawdust—Standardized emergency equipment to meet present conditions. *Wood* 6, 1941 (19–21).
[37] STILLMAN, A. L. Briquetting. The Chemical Publishing Co., Easton, Pa. 1923. (Williams & Norgate, Henrietta Street, London, W.C.2.)
[38] The corrosion of metals by wood. *Timb. Plywood* 79, 1940 (348); *Timb. Tr. J.* 154, 1940 (330).
[39] The mechanical development of a wood-briquetting machine. *Mech. Engng.* 63, 1941 (105).
[40] Uses for sawdust and shavings. *Leafl. For. Prod. Res. Lab. No.* 25 (in the press).
[41] Utilization of sawdust. *Mon. News Lett. Div. For. Prod. Aust.* No. 113, 1941.
[42] Wood flour. A general statement of the manufacture and use of wood flour and the status of the industry. Forest Products Laboratory, Madison, Wis. *Mimeo.* No. *R*565, Revised 1941.
[43] Wood refuse as fuel. *Mech. World* 106, 1939 (339); *Overseas Engr.* 14, 1941 (216–9).
[44] Wood waste and its uses. The utilization of sawdust for the production of gas and its value as a polishing agent. *Timb. News* No. 1,945, 1933 (34).

THE MACROMOLECULAR THEORY OF THE STRUCTURE AND PROPERTIES OF CELLULOSE FIBRES

Review by S. A. BRYANT, B.A., A.I.C.

A RECENT article by Staudinger,* dealing with cellulose micelles and macromolecules and their relationship to the properties of cellulose fibres and of solutions prepared from them, should be of interest to anyone who wishes to obtain a clear and comprehensive view of this subject from the chemical standpoint, but who lacks either the time or the specialized knowledge required for a critical study of the copious and rather confusing original literature.

During the last twenty years ideas regarding structure and chemical identity, so far as highly polymerized substances such as cellulose are concerned, have undergone fundamental modification. Omitting the finer points regarding the structure of glucose and the related disaccharide cellobiose, the salient facts relating to the macromolecular theory of cellulose may be briefly recapitulated as follows. The cellulose molecule is now known to consist, in its simplest form, of a long chain of anhydroglucose units. These may be regarded as glucose

* STAUDINGER, H. Über den micellaren, makromolekularen und übermolekularen Bau der Cellulose. *Cellulosechemie* 20, 1942 (1-14).

molecules, each of which has lost the elements of one molecule of water in such a way that any two adjacent links of the chain are joined together by a primary valency between an oxygen atom of one unit and a carbon atom of the other. Some or all of the hydroxyl and primary alcoholic ($-CH_2OH$) groups of the anhydroglucose units can take part in chemical reactions which do not alter the fundamental chain structure of the cellulose, and the products of such reactions may thus differ little or much in chemical properties from the original cellulose, according to what proportion of the groups in question have undergone the reaction. The chain molecules—or macromolecules as they are usually termed—in any given sample of cellulose do not necessarily all contain the same number of glucose units, nor, generally speaking, is the average chain length the same in two samples from different sources. The number of anhydroglucose units in a cellulose chain is commonly referred to as its degree of polymerization.

Macromolecules may be held together in parallel by forces which are weaker than primary valence forces, forming long bundles often termed micelles. In micellar regions in cellulose fibres, the anhydroglucose units, in consequence of the parallel orientation of the macromolecules, form a regular pattern or lattice in the same manner as the atoms or groups in a crystal, and such regions are therefore termed crystallites. Since a crystallite may be made up of macromolecules of different lengths, some of the latter may project into other regions of the fibre, and a single macromolecule may even enter into the structure of more than one crystallite. It is important to mention that the distances between the macromolecules within a crystallite are not always the same for different forms of cellulose, the dimensions of the unit cell of the crystal lattice of mercerized cellulose, for example, differing in two directions from the corresponding dimensions in untreated natural cellulose. The opinion is now generally held that cellulose and its derivatives do not exist in the form of micelles when in solution.

In Staudinger's article the subject is developed historically, beginning with a brief account of the earliest researches. Modern ideas on the constitution of cellulose can be said to have originated in 1926 with the work of Sponsler and Dore, who deduced the existence of parallel arrangements of long chains of anhydroglucose units from X-ray diffraction measurements. This fundamental conclusion was subsequently confirmed by Meyer and Mark, notwithstanding that the views of these investigators differed in some details from those of Sponsler and Dore, while W. N. Haworth improved upon it by pointing out that the anhydroglucose units must be joined glycosidically rather than by ether linkages as had at first been assumed. These ideas were in sharp contrast with the former concept of cellulose molecules which were thought to consist of a very small number of anhydroglucose units and to be bound together in micelles, which could retain their identity when dissolved in some solvents, but not in others. The evidence for this was that while cellulose and its derivatives were found to be highly colloidal in most of their solutions, nevertheless, in certain cases, notably in solutions of cellulose acetate in acetic acid, cryoscopic observations indicated a low molecular weight for the dissolved particles. The small size of the elementary cell of the cellulose lattice, as determined by X-ray diffraction measurements, was thought to support this view. Proof that such measurements could not always be taken as an indication of molecular size was forthcoming, however, from the researches of Staudinger and co-workers on the polyoxymethylenes. These products were known to be not chemically uniform, but mixtures of homologous polymers consisting of long chain molecules of different lengths, but they crystallized well, and the lattice cell was found to be of comparatively small dimensions. The lowness of the results obtained in cryoscopic molecular weight determinations with cellulose acetate in acetic acid has still not been fully explained, but it can hardly bear its former interpretation, since it has been found that a series of samples of cellulose acetate, differing among themselves in their specific viscosities (and hence in the size of their supposed micelles) in other solvents, can be dissolved in acetic acid and recovered without losing those differences. This would not be the case if all the samples had been broken down to the same small molecules in every case by the acetic acid.

After the establishment of the chain molecule concept of cellulose structure, an attempt was made by Meyer and Mark to reconcile it with the older ideas. The view was put forward that the cellulose chains consisted of a moderate number (30 to 50) of glucose units, and that the chains never existed independently in solution, but were bound together by cohesive forces in groups of 40 to 60 to form micelles. This attempted compromise has now been abandoned by its authors, although it still finds a few adherents.

Attempts have also been made to eliminate the chain molecule entirely as a factor in explaining the colloidal properties of cellulose, by referring these properties to the presence of non-cellulosic substances which are always present in native fibres. Thus Hess held that the progressive lowering of specific viscosity observed on treatment of cellulose with acids was due, not to the shortening of the macromolecules, but to the gradual removal of a non-cellulosic substance originally present as a thin skin covering a crystallite or a group of crystallites. This opinion was based partly on morphological observations and investigations on the swelling of fibres. It was later abandoned by Hess. A somewhat similar theory has also been advanced by Farr and her collaborators. Farr claims to have observed in various cellulosic membranes crystalline cellulose particles which, when separated from the cementing material in which they are naturally embedded, no longer give viscous solutions in cuprammonium. The high viscosity of ordinary solutions of cellulose in cuprammonium is really, it is alleged, due to the swelling of the cementing material, which is of a pectic nature. The cellulose particles themselves are merely suspended as such in the cuprammonium, and do not actually dissolve. The weight of evidence in favour of the macromolecular explanation of the properties of cellulose solutions, however, casts much doubt upon the validity of these claims. In Staudinger's opinion the alleged cellulose particles are merely dust particles from the atmosphere. Hock and Harris have, in fact, found that if a cuprammonium solution not containing any cellulose has been exposed to the air it will contain particles similar to those observed in a cuprammonium solution of cellulose. Some of the strongest evidence, however, against Farr's views is not mentioned by Staudinger. Treatment of natural cellulose fibres with pectin solvents to remove the cementing material does not significantly reduce their specific viscosity, provided that such treatment is carried out with sufficient care, and the cellulose residues so obtained do not

possess the properties demanded by Farr's theory. Thus E. Heuser and J. W. Green* found that cotton fibre treated with ammonium oxalate did not break down into the cellulose particles described by Farr. The treated fibre could be dissolved in cuprammonium, and the relatively slight decrease in molecular weight brought about by the treatment, as determined by measuring the viscosity of the solution, could be attributed to oxidation and hydrolysis of the cellulose itself. T. A. Howells† found that wood pulps are almost entirely soluble in cuprammonium hydroxide, and that the viscosity of the resulting solutions is not affected by pre-extraction of the pulps with pectin solvents unless acids are used, and these cause degradation of the cellulose itself as evidenced by chemical analysis.

Strong evidence for the macromolecular as opposed to the micellar state of cellulose and its derivatives in solution is provided by Staudinger's experimental proof that a cellulose sample of known degree of polymerization, as determined by viscosity measurements, may be converted by chemical treatment into a cellulose derivative, or *vice versa*, without any significant change occurring in the original chain length. Quantitative results for two such cases, the conversion of cellulose to its triacetate and back again to cellulose, and the conversion of cellulose xanthate to cellulose, are quoted. The accuracy of the calculation of degree of polymerization from specific viscosity has sometimes been questioned, but there can, nevertheless, be little doubt of the correctness of the view that the length of the macromolecular chain is the most important factor in the true explanation of the difference in colloidal properties between one sample of cellulose and another. Moreover, the results calculated from viscosity measurements agree with those obtained by means of experiments with the ultracentrifuge.

Native cotton cellulose appears to be of uniform degree of polymerization, and in Staudinger's opinion it is possible that this may be the case for every individual plant species, although the degree of polymerization may differ from one species to another. Celluloses which have been subjected to chemical treatment, however, consist of mixtures of macromolecules of different lengths. The determination of the degree of polymerization by viscosity measurements is thus an extremely important method of characterizing a sample of cellulose, and can be used in practice to follow the degradative changes which occur, for example, in bleaching.

The conception of the macromolecule as a 'chain' must not be taken necessarily to imply the existence of great independence of movement between adjacent anhydroglucose units. The closeness of the relationship between specific viscosity and chain length indicates rather that when in solution the macromolecules exist in an extended form with a degree of rigidity comparable to that possessed by a thin glass thread or steel wire. They cannot be crumpled or knotted. If the macromolecules are more or less straight when in solution, it is highly probable that they will remain so when precipitated, and thus it is unlikely that any cellulose will be precipitated from solution as a mass of macromolecules in an entirely haphazard arrangement. An explanation therefore must be sought for the fact that some precipitated celluloses possess only very slight crystallinity or none at all. This apparent difficulty is overcome by the supposition that, although the macromolecules in such cases are orientated to form crystallites, there is, nevertheless, an irregular arrangement of the crystallites themselves. Since a single crystallite is often too small to give an X-ray diffraction pattern, such celluloses may consequently appear to be amorphous. A random orientation of crystallites in artificial fibres may result from the rapidity with which the cellulose is precipitated when these are formed, in contrast with the slow rate at which it is laid down in natural fibres. The fact that fibres with different degrees of crystallinity and different strength properties can be precipitated from one and the same spinning solution can also be accounted for on the same lines. Thus the crystallites in stretch spun rayon are better orientated than those in ordinary rayon, and the latter accordingly has a greater extensibility and at the same time a lower tensile strength than the former. The crystallites tend to become more highly orientated when the fibre is stretched.

It can be assumed that, other things being equal, the strength of a cellulose fibre will be higher the higher the degree of polymerization. Unfortunately, the production of artificial fibres of increasingly high strength on this principle is limited by the fact that reasonably concentrated solutions of very highly polymerized cellulose are difficult to deal with because of their high viscosity. As indicated above, however, degree of polymerization is not the sole factor determining the strength properties of a fibre. Some artificial fibres of low degree of polymerization possess a certain amount of strength, depending on the felting together of unorientated crystallites, while natural cotton, which has been brought by chemical treatment to the same low degree of polymerization, may be much weaker owing to the frequency of the transverse faults which exist at places where a number of molecular chains come to an end together.

Natural and artificial cellulose fibres of the same degree of polymerization can differ from each other not only in strength but also in solubility. Natural celluloses, including mercerized celluloses, with a degree of polymerization greater than 500, are insoluble in 10–20 per cent. caustic soda, while regenerated celluloses with a degree of polymerization between 500 and 1,000 are soluble in 10 per cent. caustic soda. When the degree of polymerization is above 1,000, the regenerated celluloses swell strongly in 10 per cent. caustic soda, while the natural celluloses do not. Thermal degradation of cellulose has been found to have the same effect as reprecipitation on solubility in alkalies. Thus a natural cellulose, which has been degraded to a degree of polymerization of 300–400 by treatment other than heat, is not very soluble in alkali, whereas one which has been degraded to the same extent by heat is much more soluble. The differences between the alkali solubilities of various celluloses are reflected in similar differences between the solubilities of their acetates in organic solvents. Thus, natural celluloses can be converted into fibrous cellulose triacetates with a degree of polymerization over 500, and these will neither dissolve nor swell in organic solvents such as chloroform. This solvent does, however, dissolve triacetates with a degree of

* HEUSER, E., and GREEN, J. W. Behaviour of cotton fiber with ammonium oxalate and cuprammonium solution. *Industr. Engng. Chem.* 33, 1941 (868–72).

† HOWELLS, T. A. A study of the wood pulp-cuprammonium hydroxide system. *Paper Tr. J.* 113 (9), 1941 (88–94).

polymerization of 500 to 2,000 made from regenerated celluloses. On the other hand, all pure cellulose nitrates are soluble in organic solvents, although products prepared by direct nitration of lignified fibres such as kapok are insoluble. This last circumstance is explained by the existence of non-cellulosic bridges uniting the cellulose chains by cross linkages, for if the non-cellulosic constituents of kapok are removed by treatment with chlorine dioxide the residue gives a soluble nitrocellulose. The residue, moreover, is now soluble in cuprammonium, whereas the original kapok fibre was not. A somewhat similar explanation has been advanced for the behaviour of cellulose towards alkalies, the assumption being made that in natural fibres the cellulose itself possesses oxygen bridges uniting the macromolecules laterally. It is further assumed that the cross linkages in this case are broken down by cuprammonium, but not by caustic soda. The explanation is not entirely satisfactory, as it does not account for the behaviour of cellulose xanthates. A natural cellulose fibre after xanthation and regeneration without dissolving the xanthate in water remains almost insoluble in 10 per cent. caustic soda and still yields an insoluble triacetate, but if the cellulose is precipitated from an aqueous solution of the xanthate it behaves like other regenerated celluloses. It seems hardly likely that by merely dissolving the xanthate in water it would be possible to break a linkage which, by hypothesis, is unaffected by caustic soda. It is interesting to note that attempts have been made to endow regenerated celluloses with the properties of natural fibres by treatment with formaldehyde, in the hope of joining the macromolecules together by methylene bridges.

Another theory attributes the solubility properties and swelling characteristics of cellulose to albuminous or pectic bodies which are present in natural but not in regenerated fibres. This also fails to explain the properties of xanthates. According to this theory, also, it is these foreign bodies which, by hindering the swelling of parts of the fibre, cause the balloon-like formations that are observed when, for example, wood or cotton fibres are allowed to swell in cuprammonium. This ballooning is, however, still observed even if the material has previously been treated with ammonium oxalate and dilute caustic soda to remove pectin and albumin. It therefore seems much more likely that this phenomenon and the solubility differences are due purely to differences between the ways in which natural and artificial fibres are built up. Artificial fibres are formed by precipitation of macromolecules which already exist as such in solution, whereas in the growth of natural fibres glucose or cellobiose units are laid down as independent additions to macromolecules which already form parts of the crystal lattice. This results in a more compact structure, as is evidenced by the higher specific gravity of the natural fibres. The conclusion cannot be drawn, however, that the solubility differences are dependent on the lattice dimensions of the crystallites, for mercerized cotton, which has a lattice like that of regenerated fibres, has similar solubility properties to those of the natural fibre from which it is prepared. It is possible that the true explanation may be connected with the spiral orientation of the fibrils into which natural cellulosic fibres may be broken down.

Not only the reactions of cellulose to solvents but also its behaviour towards chemical reagents in general are in part dependent on its structure and the resultant nature of its surface. Chemical reactions, the course of which is conditioned by the nature of the surface of one of the reactants, have been termed topochemical reactions. They have hitherto been little studied, since the majority of organic compounds, on account of their relatively low molecular weight, usually react either in solution or in the gaseous state. In contradistinction to such low molecular compounds, a substance which reacts topochemically may exist in a number of modifications which exhibit differences in their behaviour under identical chemical treatment, even though they possess the same molecular constitution. Important examples of such topochemical reactions in the case of cellulose fibres are the action of oxygen, oxidizing agents in general, and acids. It has been shown that regenerated or mercerized fibres are more rapidly degraded by acids than natural cellulose. If the latter is nitrated with a mixture of nitric and sulphuric acids the cellulose nitrate obtained has the same degree of polymerization as the original cellulose. On the other hand, mercerized or regenerated fibres under the same conditions yield a product with a much lower degree of polymerization, a nitrate with the same degree of polymerization as the original cellulose being obtained only if phosphoric acid is used instead of sulphuric. The ratio of the degree of polymerization of the 'sulphuric' nitrate to that of the 'phosphoric' nitrate is termed the nitration number of the cellulose. This is 0·5 for mercerized or regenerated cellulose, and unity for natural cellulose.

The viscosities of highly concentrated cellulose solutions have been found to vary according to the manner in which they are prepared. For example, the viscosity of a 6 per cent. solution in acetone, of nitrocellulose with a degree of polymerization of 800 to 1,000, has been found to differ according to whether the solution is prepared directly or obtained by concentrating a more dilute solution. Again, a solution prepared by dissolving acetylcellulose in chloroform and then adding benzene is less viscous than a solution of the same composition prepared by dissolving the same acetylcellulose directly in a mixture of chloroform and benzene. These observations indicate the presence, in such solutions, of structures of a hitherto unknown nature, probably depending on the natural structure of the fibres. It is possible that in the direct preparation of concentrated solutions of natural fibres, the latter do not become uniformly solvated as in dilute solutions, but that parts of the fibre merely undergo strong swelling. The viscosity of concentrated solutions of cellulose nitrate or acetate is also influenced by the presence of traces of calcium salts. The existence of bridges linking the macromolecules together has again been assumed in order to explain this. A great deal of technical information concerning highly concentrated solutions of cellulose and its derivatives must have been accumulated in the production of artificial fibres and cell wool, but the purely scientific investigation of this side of the subject has not yet progressed very far, nor is it likely to be thoroughly understood until more knowledge is available of the differences between natural and regenerated cellulose fibres.

ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

01. TERMINOLOGY. BIBLIOGRAPHY

01.6. **Publications on forestry 1935–1940: an annotated list including reviews, abstracts, and other information. Part II: Bulletins and pamphlets.** U.S. Forest Service Library, Washington, D.C. 1941. pp. 88.

01.6 : 12.19.1 : 12.2 : 13.2 : 31.1 (410). SMART, J. [Editor.] **Bibliography of key works for the identification of the British fauna and flora.** Association for the Study of Systematics in relation to General Biology. *Publication* No. 1, 1942. pp. 105. L.C.

01.6 (78 : 79). **A bibliography of forest management, resources, and uses, with special reference to the Pacific Northwest.** National Lumber Manufacturers Association, 1337 Connecticut Avenue, Washington, D.C. 1941. pp. 15.

05.3. *Annual Reports*

05.3 (54) : 2 : 3. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

05.3 (54 : 59.1). INDIA and BURMA. **Forest research in India, 1940–41. Pt. II.—Reports for Burma and Indian Provinces.** Manager of Publications, Delhi. 1942. pp. 242.

05.3 (54.2). ORISSA. **Annual progress report on forest administration in the Province of Orissa for the year 1940–41.** Supt., Govt. Press, Cuttack, Orissa. 1942. pp. vii + 82 + 2.

05.3 (54.2). UNITED PROVINCES. **Annual progress report of forest administration in the United Provinces for the year 1940–41.** Supt., Govt. Printing & Stationery, Allahabad, U.P. 1942. pp. 5 + ii + 27 + xx.

05.3 (54.8). COORG. **Progress report of the forest administration in Coorg for 1940–41.** Mysore Residency Press, Bangalor. 1942. pp. 2 + 5 + ii + 49.

05.3 (66.4). SIERRA LEONE. **Forestry report for the year 1941.** Govt. Printer, Freetown. 1942. pp. 12.

05.3 (71.1). BRITISH COLUMBIA. **Report of the Forest Branch for the year ended December 31st, 1941.** Govt. Printer, Victoria, B.C. 1942. pp. 55.

05.3 (71.11). ALBERTA. **Annual report of the Department of Lands and Mines of the Province of Alberta for the fiscal year ended March 31st, 1941.** King's Printer, Edmonton. 1942. pp. 88.

05.3 (729.7) : 07.1–2. TRINIDAD. **The Imperial College of Tropical Agriculture. Report of the Governing Body and The Principal's Report to December 31st, 1941.** St. Augustine, Trinidad, and Grand Buildings, Trafalgar Square, London. 1942. pp. 23.

05.3 (74.4) : 44.3 : 12.26–8 : 12.21 : 12.11.22 : 12.11.15. MASSACHUSETTS. **Massachusetts Agricultural Experiment Station, annual report for the fiscal year ending November 30, 1940.** *Bull. Mass. agric. Exp. Sta.* No. 378, 1941. pp. 112.

05.3 (74.7). STATE OF NEW YORK. **Conservation Department: thirty-first annual report, for the year 1941.** New York. 1942. pp. 402. *Legislative Document* (1942) No. 32.

05.3 (76.3 : 75.8–76.6) : 12.11.3 : 23.26 : 45.3. UNITED STATES. **Twenty-first annual report, Southern Forest Experiment Station.** New Orleans, La. 1941. pp. 21.

05.3 (78.6 : 79.6–7). UNITED STATES. **Sixth annual report of the Rocky Mountain Forest and Range Experiment Station, 1941.** Fort Collins, Colorado. [1942?] pp. 14 + 46 + iii.

05.3 (79.4). CALIFORNIA. **Science, servant of agriculture: Report of the Agricultural Experiment Station, College of Agriculture, University of California, Berkeley, July 1, 1938 to June 30, 1940.** [1940?] pp. 244.

05.3 (94) : 42.5 : 12.25 : 11.47.13. AUSTRALIA. **Fifteenth annual report of the Council for Scientific and Industrial Research, for year 1940–41.** Govt. Printer, Canberra. 1941. pp. 107.

07. EDUCATION AND RESEARCH. INSTRUMENTS AND TOOLS

07.2 (485) : 3. WALDENSTRÖM, E. Utredningen rörande den tekniskvetenskapliga forskningens ordnande.—På skogsprodukternas område. **[Scheme for the organization of technical and scientific research.—Forest products.]** *Tekn. Tidskr.* 72, 1942 (204–8). [Sw.] P.O.

Details are given of the suggested organization for co-ordinated research in the field of wood utilization under a proposed institute to be established with the support of industry and the State.

07.7 : 76. PFORT, E. Schleppereinsatz im Forstbetrieb : Erfahrungsbericht aus dem Schlepperbetrieb des Forstamtes Schönlanke. **[Use of tractors in forestry: report on experience of tractors in the forest district of Schönlanke.]** *Forstarchiv* 18, 1942 (58–65). [G.]

Includes costings for cultivation work (ploughing, rolling, etc.) with a 55-h.p. and a 25-h.p. tractor, both of which proved economical.

09.1. *Forest History*

09.1 (494) : 12.19 : 12.26–8. MEYER, K. A. Holzartenwechsel und frühere Verbreitung der Eiche in der Westschweiz. Kanton Waadt: Vom Jura zum Jorat. **[Changes in tree species and the former distribution of Oak in western Switzerland. Canton of Waadt: From the Jura to the Jorat.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 22, 1941 (63–141). [G.g.f.]

09.2. *Pre-history*

09.2 (43.1–5). HOLDHEIDE, W. Über zwei Funde prähistorischer Holzkohlen. **[On two finds of prehistoric charcoals.]** *Ber. dtsch. bot. Ges.* 59, 1941 (85–98). [G.] R.M.I.

The representation of different tree species in 96 mesolithic charcoal samples from Probstfels, near Beuron, and 37 palaeolithic samples from 'Schafstale', near Veringenstadt, Hohenzollern, agreed well with results from pollen analyses and other data.

09.2 (43.1–5). BERTSCH, K. Die spätglaziale Waldentwicklung. **[Development of forests in the late glacial period.]** *Ber. dtsch. bot. Ges.* 59, 1941 (99–103). [G.] R.M.I.

The status during the ice age of *Pinus montana*, *P. sylvestris*, and *Betula* in the Federsee marshes is described and discussed. The marked agreement of the results with those of Aario in Finland is noted.

09.2 (74 : 75 : 71). SMITH, P. **Correlations of pollen profiles from glaciated eastern North America.** *Amer. J. Sci.* 238, 1940 (597–601). [Yale University.] L.S.

A brief *interim* statement of the author's conclusions, which are shortly to be presented in a detailed report.

09.2 (79.4). AXELROD, D. I. **The Mint Canyon flora of southern California: a preliminary statement.** *Amer. J. Sci.* 238, 1940 (577–85). [U.S. National Museum, Washington, D.C.] L.S.

A discussion of the composition of this Miocene flora—which was essentially an Oak savanna community—and of its relation to past and present vegetation and climate.

09.2 (79.5). HANSEN, H. P. **Post-Mount Mazama forest succession on the east slope of the central Cascades of Oregon.** *Amer. Midl. Nat.* 27, 1942 (523–34). [Oregon State College, Corvallis.] L.S.

09.2 (79.5). HANSEN, H. P. **The influence of volcanic eruptions upon post-Pleistocene forest succession in central Oregon.** *Amer. J. Bot.* 29, 1942 (214–9). [Oregon State College, Corvallis.] O.B.D.

09.2 (79.5). HANSEN, H. P. **A pollen study of lake sediments in the lower Willamette Valley of western Oregon.** *Bull. Torrey bot. Cl.* 69, 1942 (262–80). [Dept. of Botany, Oregon State College, Corvallis.] O.B.D.

With reference to post-glacial forest succession and climatic trends.

09.4. *Forest Statistics*

09.4 : 33.32. **Wood pulp statistics.** United States Pulp Producers Association, 122 East 42nd Street, New York. 1941. pp. 120. [U.S. Pulp Producers Association.]

09.4 (44) : 09.7. CROCOLL. Die Forstwirtschaft im Elsass. **[Forestry in Alsace.]** *Dtsch. Forstztg.* 9, 1940 (397–401). [G.] *Abstr.* in *Holz* 4, 1941 (292). [G.] P.R.

Approximate percentage figures are given for forest area, distribution of forests by ownership, and proportions of chief timber species.

09.4 (45) : 07.7. PAVARI, A. Die waldbaulichen Verhältnisse Italiens. **[Forest conditions of Italy.]** *Z. Weltforstwirt.* 8, 1941 (175–215). [G.] *Abstr.* in *Holz* 4, 1941 (292). [G.] P.R.

The ecological basis of Italian forestry is outlined, followed by statistics and notes on the individual types of forest and their products.

09.4 (47.2–6 : 57) : 09.7 : 98. GAGARIN, E. Die Hauptrohstoffgebiete des russischen Holzexports. **[The chief regions furnishing the raw material of the Russian timber exports.]** *Intersylva* 1, 1941 (415–33). [G.] *Abstr.* in *Forstarchiv* 18, 1942 (71–3). [G.]

Three forest regions considered to be of primary importance for the present and prospective exports of timber from the U.S.S.R. are discussed in some detail.

(1) The far-eastern region, roughly between Vladivostok and Komsomolsk, with about 109 million ha. of forest and an estimated growing stock and exploitable annual increment of 7,000 million cu.m. and 120 million cu. m., respectively. So far this region has been little utilized.

(2) The Yenesei-Angara region, with some 15 million ha. of forest having an estimated growing stock of 963 million cu. m., which at present is the chief source of Siberian exports. Most of the stands are in the proximity of rivers. In 1936 the modernized Igarka harbour handled 200,000 cu. m. of export timber. This harbour, though situated 690 km. from the mouth of the Yenesei, can be reached by seafaring steamers.

(3) The European north, with 34 million ha. in mature and over-mature stands alone. The present cut of 25–30 million cu. m. per annum represents only about 1 per cent. of the growing stock of the region, and much less than the exploitable annual increment. The region is considered to be capable of yielding annually 15–20 million cu. m. of timber for export purposes, and about the same amount of export timber could be made available from the two Siberian regions.

09.4 (498). SABĂU, V. [condensed translation by R. MÜLLER.] Forststatistik in Rumänien. **[Forest statistics in Rumania.]** *Forstarchiv* 18, 1942 (65–8). [G.]

Critical notes on past statistical surveys of the forests of Rumania.

09.4 (71). **Estimate of forest production. Operations in the woods in Canada 1940.** Dominion Bureau of Statistics, Ottawa. 1942. pp. 10. [E.F.]

About 3¼ billion cu. ft. of standing timber were cut in Canadian forests in 1940. In addition 307 million cu. ft. of merchantable timber were destroyed by fire. Total quantity and value are given for the various forest products for the year, the most important of which were logs and bolts (39 per cent. by volume), pulpwood (30 per cent.), and firewood (26 per cent.).

09.4 (71) : 09.7. CAMERON, D. R. **Canada's forests.** *Timber of Canada* 2 (4), 1941–42 (33–8). [Dominion Forest Service.]

A general account of the importance of forests and the wood-products industries in Canada's national economy.

09.4 (728.1) : 98. **Lumber industry and trade of Guatemala.** *Industr. Ref. Serv. U.S. Dep. Comm., Pt. 4. For. Prod.*, No. 30, 1941. pp. 4.

09.4 (73) : 34.26 : 98. HALLAUER, F. J., HALL, J. A., BROWN, F. L., CURRAN, C. E., and BAIRD, P. K. **Timber requirements for naval stores: an analysis of production and consumption of turpentine and rosin.** U.S.D.A. Forest Service, Washington, D. C. 1941. pp. 95.

Includes a discussion of U.S. and foreign market requirements and production, and an estimate of the forest acreage that would have to be subjected to exploitation to satisfy the prospective internal and

export demand for turpentine and rosin. This acreage is put at 20 million.

09.4 (79.4). **California forest statistics.** *Tech. Note Calif. For. & Range Exp. Sta.* No. 16, 1941. pp. 17.

09.7. *Monographs of Individual Forest Regions*

09.7 (492). JAGER GERLINGS, J. H. Die forstlichen Verhältnisse der Niederlande. **[The forest conditions of Holland.]** *Z. Weltforstwirt.* 9, 1941–42 (1–50). [G.e.f.]

A summary of information on the forests, their management and utilization, and on forestry research and education in Holland.

09.7 (54.1) : 09.4. JACOB, M. C. **The forest resources of Assam.** *Publ. Assam For. Dep.* No. 13, 1940. pp. xii + 48.

A summary of information on the forests, their management, and their utilization, and the character and uses of the principal tree species.

09.7 (54.4) : 11.62.3 : 42.22. SOTHERS, D. B. **Riverain forests in Sind, 1936–41.** *Indian For.* 67, 1941 (637–42).

These forests are composed chiefly of *Acacia arabica* and *Prosopis spicigera*, with some *Tamarix* spp. and *Populus euphratica*. They correspond roughly to the land directly accessible to the Indus floods, on which they are almost entirely dependent, as rainfall and particularly summer rainfall is very infrequent. The land varies in level by 5 ft. or more, and to be of general benefit the floods must be high and reach some miles inland. A succession of poor flood seasons has been experienced between 1936 and 1940. Much damage became apparent by the end of the second year, the situation has grown progressively worse, and over 100,000 acres now contain only dead trees or, where these have been cut, are treeless. *A. arabica* has usually succumbed after 2 consecutive years and *P. spicigera* after 3–5 consecutive years of drought. If certain extensive irrigation schemes come into being the flood level will be further lowered and further large tracts of forest will go out of production. In addition, it is possible that anti-erosion work in the Punjab may unfavourably affect the peak flood level of the Indus. The only favourable feature of the poor floods is that the Forest Department has been enabled to regenerate, mainly with *A. arabica*, large areas of river deposits and other low-lying land that formerly received too much water for successful sowings to be made. Satisfactory young crops have now been established on 120,000 acres of such land.

09.7 (560). HAFNER, F. Die Waldgebiete bei Ayancik in Nordwestanatolien. **[The forest regions of Ayancik in north-west Anatolia.]** *Der Biologe* 10, 1941 (181–5). [G.] *Bot. Zbl.* 35, 1941 (209). R.M.I.

09.7 (72) : 12.19. MEYER, H. A. **Forestry in Mexico.** *Chron. bot.* 6, 1941 (395–9). [Allegheny Forest Exp. Sta.] O.B.D.

A brief review, arranged under the headings:—history of the Mexican forestry movement; area, distribution and types of forests; forest legislation and organization of the Mexican Forest Service; and accomplishments and future problems of Mexican forestry.

09.7 (728.1) : 12.19. POPENOE, W. **Plant resources of Guatemala.** *Chron. bot.* 7, 1942 (16–8). [United Fruit Co., Guatemala City.] O.B.D.

A review, with chief reference to natural zones and agriculture. There are many good timbers available, and a small, occasional export trade in some of them. The chief species are *Cupressus benthami*, several species of *Pinus*, *Abies religiosa*, *Swietenia macrophylla*, *Cedrela mexicana*, *Guaiacum* spp., and *Tabebuia donnell-smithii*. Forestry has received little attention as yet, and there is need for work on reforestation, forest pathology, and for erosion control in deforested areas. [Cf. *For. Abs.* 3 (193).]

09.7 (728.6) : 12.19. SKUTCH, A. F. **The natural resources of Costa Rica.** *Chron. bot.* 6, 1941 (399–402). O.B.D.

A condensed account of the vegetation and economic products of Costa Rica. Important timber trees are Cedro or Spanish Cedar (*Cedrela* spp.), Mahogany, Laurel (*Cordia alliodora*), Pochote (*Bombacopsis fendleri*), Cocobola (*Dalbergia retusa*), and a large group of lauraceous trees variously designated Ira and Quizarrá (*Nectandra* and related genera). All accessible regions furnish some lumber and the number of species used for this purpose is very large.

09.7 (729.6). HODGE, W. H. **The natural resources of the Lesser Antilles.** *Chron. bot.* 6, 1941 (448–9). [Massachusetts State College, Amherst.] O.B.D.

With the exception of Guadeloupe, Dominica, St. Lucia and St. Vincent, deforestation has been extensive and forestry problems are relatively unimportant. The most important function of local forests is in soil and water conservation. Active forest protection has been established only on a few islands, notably St. Kitts and Guadeloupe, and only the latter possesses a forestry department. Managed forests might well be established on islands like Dominica, St. Lucia, and St. Vincent. Shifting cultivation is a serious menace to the forests.

09.7 (77.7) : 11.62.1. LARSEN, J. A., and DILWORTH, J. R. **Notes on the forests of southern Iowa.** *Proc. Ia. Acad. Sci. 1939*, 46, 1940 (141–7). [Iowa State College, Ames.] L.S.

A conference paper reviewing from the literature the forestry situation in this region, which is a dissected upland plain on which the original forests of Oak and other hardwoods have mostly given way to agricultural cultivation, except on the steeper slopes and narrower bottoms. Soil erosion and the depleted condition of the present forests render a conservation programme urgently desirable.

09.7 (84). CÁRDENAS, M. Recursos naturales del reino vegetal en Bolivia. **[Natural resources of the vegetable kingdom in Bolivia.]** *Chron. bot.* 6, 1941 (404–6). [Span.] [Universidad Autonoma de Cochabamba, Bolivia.] O.B.D.

With main reference to prospects for agricultural exploitation. Large resources of timber, mostly of species as yet unknown to the world market, exist in the Amazonian forests and in the Llanos Orientales (Departments of Santa Cruz and Cochabamba). The medicinal trees Copaiba (*Copaifera*) and Chiriguana (*Simaruba glauca*) occur in plenty in the pampas regions of Yacuma and Mojos.

09.7 (86) : 12.19 : 34.25. ACOSTA SOLIS, M. Vegetación y riqueza forestal de la provincia de Esmeraldas (Ecuador). **[Vegetation and forest resources of the province of Esmeraldas (Ecuador).]** *Maderil* 14 (164;

165), 1942 (11–4, 25–8; 13–6). [Span.] [Instituto Ecuatoriano de Ciencias Naturales.]

The vegetation of the Province consists in the main of evergreen rain forest. The paper includes two annotated lists giving the common, and where known the botanical, name of (1) the principal medicinal plants and (2) the chief forest tree species that are being utilized.

09.7 (87). WILLIAMS, L. **Natural resources of Venezuela.** *Chron. bot.* 7, 1942 (75–7). [Field Museum of Natural History, Chicago.] O.B.D.

Notes are included on the chief timbers and othe forest products.

09.7 (89). BOERGER, A. Recursos vegetales de Uruguay. **[Vegetable resources of Uruguay.]** *Chron bot.* 7, 1942 (27–9). [Span.] [Instituto Fitotécnico y Semillero Nacional, 'La Estanzuela', Depto. Colonia R. O. del Uruguay.] O.B.D.

A brief review, with main reference to agriculture The country has practically no forest resources; o importance and emphasis therefore falls on fores plantations, chiefly of Eucalypts and Pines.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.12. Pressure and Movement of Air

11.12. KOCH, H.-G. Der Waldwind: Eine forst-meteorologische Eigenart von Waldgebieten. **[The forest wind: A meteorological peculiarity of forest regions.]** *Forstwiss. Cbl.* 64, 1942 (97–111). [G.]

It has been observed in Germany that on clear, still nights in level country a very light breeze blows from forests into surrounding fields where it can be noticed in proximity of the ground up to 1 km. distance from the forest. The wind is caused by cool air flowing from the crowns of the canopy into the surrounding fields; its speed is 0·5 to 1 m. per sec. It is mostly observed in the middle and towards the end of summer, and is confined to forests whose canopy is fairly high above the ground.

11.4. *Soil*

11.4 : 12.11.23. RUSSELL, SIR E. J. **Soil conditions and plant growth.** Longmans, Green & Co., London, New York, and Toronto. 7th ed., 2nd impr., 1942. pp. 655. [Rothamsted Experimental Sta.]

11.41. Soil Physics

11.41.3 : 56 : 12.26–8. KHARITONOVICH, F. N. **Seasonal increment of Oak under the conditions of the eroded and alluvial soils of the south-eastern slope of the 'Kashlagach' valley.** *Pedology* 1941 (3), (96–102). [R.] L.S.

Further evidence in support of the proposition that in the steppe the amount and periodicity of seasonal growth depend chiefly on the moisture available to the trees. On eroded dry and saline soils with low-lying ground water, the diameter increment of Oak in the course of the season was smaller than on alluvial soils with ground water accessible to the roots and not particularly saline. Also in the former soils cambial activity ceased earlier in the season than in the latter. The amount of rainfall during the vegetation period influenced diameter growth in both types of soil, but chiefly in the eroded dry soil.

11.41.3 : 91.3 : 22.1. DRYUCHENKO, M. M. **Influence of forest on ground water.** *Pedology* 1941 (3), (69–88). [R.g.] L.S.

Vysotski's proposition that forests desiccate soils and lower the ground-water level more than other forms of vegetation is discussed and supported by further experimental data. Deciduous forests lowered the water table 1½–2 times as much as did Pine forests. While clear-felling on sandy soils is considered admissible as far as the water economy is concerned, fellings on marsh, gley-podzol, and meadow soils should be selective so as to avoid waterlogging.

11.41.8 : 12.14.3 : 42.1. LUTZ, H. J., and GRISWOLD, F. S. **The influence of tree roots on soil morphology.** *Amer. J. Sci.* 237, 1939 (389–400). [Yale University.] L.S.

Freezing and thawing under a periglacial climate have been put forward by some geologists to explain the frequent evidence of disturbance observable in soil profiles. The present writers point out that tree roots may cause profound and diverse disturbances that may well account for many of the morphological features of profiles developed under forest stands. A review of literature suggests that soil horizons may be disturbed (*a*) by the raising of masses of soil when trees are overturned, (*b*) by the filling of cavities left by the decay of roots, (*c*) by the pushing aside of soil material during growth, and (*d*) by agitation of the soil as the trees sway in strong winds. Evidence is presented from field studies of soil disturbances due mainly to windthrow and subsequent movement of soil materials.

11.42. Soil Chemistry

11.42. MORGAN, M. F. **Chemical soil diagnosis by the Universal Soil Testing System.** *Bull. Conn. agric. Exp. Sta.* No. 450, 1941. pp. 579–628 + plates.

The soil testing methods developed at the Connecticut Agricultural Experiment Station during the past 10 years have been based on the employment of a half-normal acetic acid solution, buffered at 4.8 pH with sodium acetate, for the soil extraction. This scheme of testing, designated as the 'Universal Soil Testing System', has been found to be of great value in chemical soil diagnosis in many parts of the U.S.A. as well as in numerous other countries. The revised methods used in these tests are presented in detail. Routine tests, of general application, cover the following: nitrate and ammonia nitrogen, phosphorus, potassium, calcium, magnesium, aluminium, and manganese. Special tests provide indications relative to the following constituents; iron, both ferric and ferrous, sulphates, nitrites, sodium, chlorides, carbonates, boron, zinc, copper, mercury, lead, and arsenic. The use of the tests for plant tissue testing, the examination of drainage and irrigation waters and other dilute aqueous solutions, and the testing of saline and alkali soils are also presented. Considerations involved in the practical interpretation of the tests under various conditions are discussed at length. A systematic scheme for applying these interpretations in estimating fertilizer needs is proposed. *From author's summary.*

11.42 : 11.62.22. LUNT, H. A. **Forest lysimeter studies under hardwoods.** *Bull. Conn. agric. Exp. Sta.* No. 449, 1941. pp. 521–72.

An account of studies with tank (fill-in type) and pan (Ebermayer type) lysimeters in a mixed hardwood stand. The bulk of the material leached out from the A_0 horizon, including nitrogen in different forms, organic matter, calcium, magnesium, potassium, sulphur, iron, silica, and phosphorus, was either taken up by the roots or fixed in the soil so that only a very small portion of it went deeper than 4 in.

11.42.1 : 11.47. TAMM, O. Några synpunkter på den svenska skogens fosfatfråga. **[Some points of view on the phosphate problem in Swedish forests.]** *Svensk bot. Tidskr.* 36, 1942 (383–9). [Sw.] L.S.

A strong protest is made against the assessment of the phosphate status of Swedish forest soils by analytical methods primarily designed for soils under field crops. Any chemical methods for determining the nutrient requirements in forest soils must differ widely from these. The phosphate requirements per ha. per year are much lower in the important forest trees than in field crops. Pine, Spruce, and Birch, in particular, often do well on soils that are extremely poor judged by agricultural standards, and are most probably able to make better use of 'bound' soil nutrients than are agricultural plants. Particular stress is laid on the occurrence of apatite in moraine deposits, gravels, sands, etc., and on the probability that this mineral may furnish phosphate directly to forest trees, as it is comparatively soluble under acid conditions. Trees have a long life, and the amount of nutrients available at a particular time does not correspond to what may become so throughout their lifetime. Harvesting timber does not remove any appreciable quantity of phosphate, as the stems contain only negligible amounts and the slash is left on the site. Losses by leaching are also slight owing to good retention of phosphate ions by the soil. The fertilizing of forest soils, if economically practicable, would imply the use of relatively insoluble fertilizers that would release their nutrients gradually over a long period.

11.43. Biology of Soil, including Mycorrhiza

11.43.1 : 12.11.15. MELIN, E., and NORKRANS, B. Über den Einfluss der Pyrimidin und der Thiazolkomponente des Aneurins auf das Wachstum von Wurzelpilzen. **[On the influence of the pyrimidine and thiazole components of aneurin on the growth of root fungi.]** *Svensk bot. Tidskr.* 36, 1942 (271–86). [G.g.] L.S.

11.43.1 : 12.25. FRIES, N. Einspormyzelien einiger Basidiomyceten als Mykorrhizabildner von Kiefer und Fichte. **[Single-spore mycelia of some basidiomycetes as mycorrhiza formers in Pine and Spruce.]** *Svensk bot. Tidskr.* 36, 1942 (151–6). [G.] L.S.

Mycorrhiza on Pine or Spruce were obtained by inoculation with single-spore mycelia of *Tricholoma pessundatum*, *Boletus granulatus*, *B. luteus*, and *Scleroderma aurantium*. The single-spore mycelia of the last-named species were almost certainly haploid.

11.43.1 : 12.26–8. HOW, J. E. **The mycorrhizal relations of Larch. III. Mycorrhiza formation in nature.** *Ann. Bot., Lond.* (*n.s.*) 6, 1942 (103–29). [Dept. of Botany, Bedford College, London.] O.B.D.

(i) The roots of European Larch can be grouped into two classes, lateral and sublateral roots, corresponding to the long and short roots of Pine. The majority of the mycorrhizas are normally formed by the infection of the sublateral roots, a few by the infection of lateral roots. (ii) *Boletus elegans* and *Paxillus involutus* have been isolated from Larch mycorrhizas; *Mycelium radicis atrovirens* from pseudo-mycorrhizas. (iii) Evidence is produced that infection of the sublateral roots by a mycorrhiza-former such as *B. elegans* results in an increase in the number of cortical cells in the root as compared with either uninfected sublateral roots or pseudo-mycorrhizas. (iv) Detailed descriptions are given of the structural features resulting from infection by *Boletus elegans*, *Paxillus involutus*, a yellow hymenomycete mycelium, *Mycelium radicis atrovirens* and two unidentified mycelia. (v) The general features of mycorrhiza formation in Larch are discussed. *Author's summary.* [Cf. *For. Abs.* 3 (103).]

11.43.2 : 11.47.6 : 13.2. JOACHIM, A. W. R., and KANDIAH, S. **Studies on Ceylon soils. XIV. A comparison of soils from termite mounds and adjacent land.** *Trop. Agriculturist* 95, 1940 (333–8). L.S.

Analyses of five pairs of samples of termite mound earths and of the adjoining soils have revealed that, in general, except where the soils are light-textured, termite earths are poorer in organic matter, nitrogen and replaceable bases than the adjacent soils. These findings do not obtain in the case of hemispherical mounds found in low-lying areas. The 'comb' material is organic in nature and of fairly high fertilizing value, and would add materially to the nutrient status of the earth when incorporated with it. Earthworm casts are considerably richer in plant fertilizing constituents than the soils on which they occur. *From authors' summary.*

11.43.2 : 11.47.6 : 13.2. PENDLETON, R. L. **Some results of termite activity in Thailand soils.** *Repr.* from *Thai Science Bulletin* 3 (2), 1941 (29–53 + plates). [Department of Agriculture, Bangkok.] H.S.B.

Large termite mounds, often more than 2 m. high and 5–6 m. in basal diameter, are common over much of Thailand except for the low, deeply flooded plains, and are distributed with remarkable regularity, frequently at the rate of about one per acre. Their natural vegetation usually consists of a dense growth of trees and brush of species that do not thrive on adjacent paddy or sandy forest land. Various crops that grow poorly or fail on normal soils, unless heavily manured, can be successfully grown on the mounds. Physical soil tests made on samples from a number of localities showed that the termite-mound soils had usually a higher clay fraction and higher air-dry moisture content, pore space, water absorption and volume expansion than had normal soils from adjacent land. Values for sticky point and rolling-out limit were also higher especially in mound soils on sandy soil types, but the differences in these properties and the non-plastic range were not striking and were much influenced by soil type and horizon. Physical differences between mound and normal soils were greatest where the latter were light in texture and thoroughly leached. The chief result of chemical analyses was the demonstration of higher Ca contents, higher pH values and generally higher values for exchangeable bases in the mound soils. Samples from the base of the mounds were often definitely basic, in contrast to the acid soils of adjacent land. Concretions commonly found at the base of

mounds have proved to be highly calcareous in comparison with those from neighbouring normal soils, which were of the iron-concretion type. No satisfactory explanation can be offered for the accumulation of calcareous matter in the mounds. Native farmers use the mounds for raising special crops and often level off the tops for this purpose, though they seldom break down the mounds to ground level. Where mounds are destroyed and the earth spread about, the productivity of the land is irregular, and it is recommended that if complete levelling is justified the earth should be well spread over a considerable area and mixed with the normal soil by thorough ploughing. Peculiar conditions appear to exist in part of Sukotai Province, on relatively fertile brown silt-loam to silty clay-loam soils, where tobacco grows better on completely levelled mound sites than on normal field soils, whereas cassava, which requires a fertile soil, failed on similar sites.

11.44. Litter. Surface Humus

11.44 : 11.41.1. HENDRICKS, B. A. **Effect of forest litter on soil temperature.** *Chron. bot.* 6, 1941 (440–1). [Southwestern Forest & Range Exp. Sta.] O.B.D.

Temperature recordings at a depth of 3 in. in bare and litter-covered ground under Oak (chiefly *Quercus arizonica* and *Q. emoryi*) groves and chaparral vegetation showed that for an 8-week period in October and November, 1938, the average daily minimum was 44° F. for bare soils and 49° F. for those covered with litter. The average daily maximum was 62° F. for bare soils and 55° F. for those with litter, thus the daily temperature range was about 18° F. for the former and 6° F. for the latter. Hourly records showed a lag of several hours between air and soil temperatures. The probable advantages of litter in promoting infiltration and creating a favourable environment for revegetation are noted.

11.44 : 11.47 : 21.32. SÜCHTING, H. Untersuchungen über die Ernährungsverhältnisse des Waldes. VI. Vergleichende Prüfung von A_0-Humusarten auf Nährstofflieferung durch Vegetationsversuche mit Kiefer und Fichte sowie auf Nährstofflöslichkeit vermittels chemischer Untersuchungsmethoden. **[Research on the nutritional relationships of the forest. VI. Comparative tests of A_0 humus types for nutrient supply by growth experiments with Pine and Spruce and for nutrient solubility by chemical methods of investigation.]** *Bodenk. PflErnähr.* 24, 1941 (87–112). [G.] R.M.I.

The experiments were designed to furnish data on K, Ca, P_2O_5, and N in the humus, the ability of the plant to use these nutrients, the effect of pH, and the effect of changing the pH by liming. The acid and nutrient status of the humus types is shown to depend largely upon the chemical character of the mineral soil and not on the tree species from which the humus is derived. Liming was found to be effective only on humus soils with a pH of 3 or less, and in this connexion the possible effect of Al as a toxic agent is discussed. The uptake of K from humus is very high, and more is taken up when the plants are fertilized. Pine responded better than Spruce to K fertilizer. Plants fertilized with K remained free from attack by grey mould. P_2O_5 uptake was also great in the humus types examined. Further study is needed on the status of N in the humus. In order to make the root-soluble nutrients of the A_0 humus sufficient for the trees, the humus must be mixed with the mineral soil; this is achieved by rain and animal activity. Data are given on the solubility of the K and P_2O_5 of the humus according to determinations made by chemical methods.

11.44 : 11.49.0 : 11.42.1. RODE, A. A. **Some data on the physico-chemical properties of the water-soluble matter of forest litter.** *Pedology* 1941 (3), (103–28). [R.g.] L.S.

The content of water-soluble organic matter of forest litter on different podzol types increased with the degree of podzolization.

11.44 : 12.25 : 12.26–8 : 12.11.11. LYFORD, W. H. **Mineral composition of freshly fallen White Pine and Red Maple leaves.** *Tech. Bull. N. H. agric. Exp. Sta.* No. 77, 1941. pp. 12.

Red Maple and White Pine leaves were collected from several sites on the same soil type (Gloucester sandy loam) and ash analyses were made. Per cent. of ash averaged 6·21 and 2·62 respectively and it was shown that the ash of Red Maple, as compared to that of White Pine, contains a larger proportion of silica and a smaller proportion of calcium. Leaves high in ash one year tend to be high the second year and in years when Red Maple leaves are high in ash content, nearby White Pine needles are low, and *vice versa.*

11.47. Maintenance of Favourable Soil Conditions

11.47 : 21.32 : 12.11.12. SÜCHTING, H. Untersuchungen über die Ernährungsverhältnisse des Waldes. V. Vergleichende Prüfung von Waldböden auf Nährstofflieferung durch Vegetationsversuche mit Lärche, Kiefer und Fichte sowie auf Nährstofflöslichkeit durch chemische Untersuchungsmethoden. **[Research on the nutritional relationships of the forest. V. Comparative tests of forest soils for nutrient supply by growth experiments with Larch, Pine, and Spruce, and for nutrient solubility by chemical methods of experimentation.]** *Bodenk. PflErnähr.* 19, 1940 (125–60). [G.] R.M.I.

The present experiments were designed primarily to afford a statistical test and comparison, using very different types of soil, of the methods used to investigate the nutrient conditions in forest soils. The results obtained showed good correspondence with those of the first experiments made in 1937, and the vegetation test, with certain slight modifications, is approved as a standard method. Chemical determinations of the capacity of the plant to take up K from the soil agreed well with the results of the vegetation test as in the 1937 experiments. Results from chemical methods of determining P_2O_5 uptake also agreed with those of previous years. The fixation of P_2O_5 applied as fertilizer was shown to vary greatly in different soils. General nutrient deficiency was so marked in nearly all the soils that the best growth could be obtained only by complete fertilizing with Ca, K, P_2O_5, and N. All the soils were deficient in K and P_2O_5 and most of them in N. [Cf. *For. Abs.* 1 (231).]

11.47 : 22.89 : 12.25 : 42.5. NĚMEC, A. Meliorationsversuche bei kümmernden Kulturen durch Düngung und Mitanbau der Dauerlupine. **[Experiments on the improvement of stagnating plantations by fertilizing and the simultaneous cultivation of perennial lupin.]** *Forstarchiv* 18, 1942 (95–101). [G.]

Czech experience with Pine and Spruce plantations

on acid, impoverished and heather-infested soils indicates that a combination of liming, fertilizing, and cultivation of perennial lupin between the rows of trees is a good means of improving such soils and of overcoming growth stagnation in Pine and Spruce. Two instances of the application of this method are described.

11.47.1. WEINKAUFF, R. Die Fortentwicklung der Forstwirtschaft durch N-Düngung. **[Further development of forestry by means of nitrogenous fertilizing.]** *Forstwiss. Cbl.* 63, 1941 (243–55). [G.]

On the basis of the available evidence, especially that obtained in Fabricius' investigation [cf. *For. Abs.* 3 (104)], the author argues that the productivity of German forests could be increased by nitrogenous fertilizing, should the need arise to make the country entirely self-sufficient in timber.

11.47.1 : 12.25 : 22.89. WILDE, S. A., TRENK, F. B., and ALBERT, A. R. **Effect of mineral fertilizers, peat and compost on the growth of Red Pine plantations.** *J. For.* 40, 1942 (481–4). [Wisconsin Agricultural Exp. Sta.]

The effect of commercial fertilizers, various peats, and compost upon the survival and growth of Red Pine (*Pinus resinosa*) plantations has been investigated on a depleted outwash sandy soil. Fertilizing materials were applied either broadcast prior to planting, or in the planting holes. Applications of fertilizers exerted no significant beneficial effect upon the survival of seedlings. Heavy applications of peat, compost, and commercial fertilizers decreased appreciably the survival of planted trees. The ill effects are believed due to the injury of planting stock by salts in solution, increased competition of weeds, and the decrease in the content of available water by organic remains of high hygroscopicity. The maximum average increase in height growth, achieved in broadcast fertilization, was about 30 per cent.; the maximum increase in average height in localized application of fertilizers did not exceed 12 per cent. Alkaline peat and horse manure depressed the growth.

The results obtained with the most successful treatments of Red Pine plantations hardly justify the cost of fertilizers and extra labour. The failure of the plantations studied to respond appreciably to fertilizer treatments, even on a depleted sandy soil, is attributed primarily to the high 'nutrient-utilization efficiency' of this species. A warning is given against fertilizer treatments of plantations on soils in which a radical nutrient deficiency has not been clearly established. *From authors' summary.*

11.47.13 : 12.26–8 : 23.27. PRIDHAM, A. M. S. **Response of Red Oak to fertilization with ammonium sulfate.** *Proc. Amer. Soc. hort. Sci.* 39, 1941 (439). [Cornell University, Ithaca, N.Y.] E.M.B.

Applications of ammonium sulphate or 6–8–4 complete fertilizer improved foliage colour and delayed autumn coloration but failed to produce any marked increase in diameter increment.

11.47.2 : 12.26–8 : 23.3. ALBERT, R. Die Roterle als Urbarmachungsholzart bei der Ödlandsaufforstung sowie als Misch- und Treibholz der Kiefer bei der Sanierung devastierter Waldböden. **[Common Alder as a soil improver in the afforestation of waste land and as an admixture and nurse species for Scots Pine in the rehabilitation of devastated forest soils.]** *Mitt. H.-Göring-Akad. dtsch. Forstwiss.* 1, 1941 (126–32). [G.] *Abstr.* in *Forstarchiv* 18, 1942 (101). [G.]

Report on Heuson's plantations [cf. *For. Abs.* 1 (15)] on tips and devastated forest soils in Niederlausitz. Thorough ploughing to a depth of 40 cm. is necessary on the latter.

11.47.6 : 11.42 : 64. SÜCHTING, H. Zur Kennzeichnung und Gütebewertung von Waldböden. II. Magnesiareiche Verwitterungsböden aus Silur, Devon und Kulm des Harzes. **[On the characterization and quality assessment of forest soils. II. Magnesia-rich soils derived from weathering of Silurian, Devonian and Kulm in the Harz region.]** *Bodenk. PflErnähr.* 27, 1942 (289–310). [G.g.] H.S.B.

An attempt is made to characterize the fertility of these soils for forestry purposes on the basis of their chemical properties, notably their content of K_2O and P_2O_5.

11.49. Soil Types

11.49 (54.87). JOACHIM, A. W. R., and KANDIAH, S. **Studies on Ceylon soils. XIII. Some forest and other characteristic soil types of the wet and dry zones.** *Trop. Agriculturist* 95, 1940 (268–77). L.S. .

11.49.3 : 11.47.6 : 11.42 : 11.43.1 : 21.3. WHITE, D. P. **Prairie soil as a medium for tree growth.** *Ecology* 22, 1941 (398–407). [University of Wisconsin.]

Chemical and biological aspects of Wisconsin prairie soils were investigated in the laboratory and greenhouse with respect to their effect upon tree growth. The greenhouse trials showed definitely that the early development of both conifers and hardwoods is adversely affected by some inherent deficiency of the prairie soils irrespective of the environmental conditions. Chemical analyses revealed that the virgin prairie soils studied are somewhat deficient in available phosphorus and potassium, but not to such an extent as to cause the early degeneration of trees. Reaction of soil, content of carbonates, and concentration of salts, advanced as factors limiting distribution of trees in the chernozem region, were not found detrimental in Wisconsin prairie soils. No adverse influence could be attributed to either carbon : nitrogen or calcium : magnesium ratios.

Pot culture experiments showed that seedlings of Red and Green Ash (*Fraxinus pennsylvanica* and *F. lanceolata*) and of American Elm (*Ulmus americana*) responded to fertilizer treatments, but even the application of fertilizers, including major and minor elements, produced yields on the prairie soils only half as great as were produced on untreated forest soils.

Analyses of leaf tissue of the Elm seedlings grown on forest and prairie soils showed about the same percentage content of nitrogen, phosphorus, and calcium; a much lower content of potash was observed in the tissue of seedlings raised on prairie soils. Seedlings of Red Pine (*Pinus resinosa*) and White Pine (*P. strobus*) raised on virgin prairie soil had sparse secondary roots and abundant root-hair development; seedlings simultaneously raised on prairie soils mixed with 10 per cent. of the humus sand from a forest nursery exhibited numerous secondary roots and abundant development of mycorrhizae. Isolation of the fungus, and reinoculation of Red Pine with pure culture in sterile media showed an improvement in the development of both root systems and crowns of the seedlings.

The results of this study suggest that mycorrhizae do not merely increase the availability of difficultly soluble

compounds, but exert a specific growth-promoting effect upon forest seedlings. The lack of this growth-promoting action appears to be the major condition inhibiting the growth of trees on mycorrhizae-free prairie soils. *Author's summary.*

11.6. *Hydrographical Conditions. Water and Soil Conservation*

11.62 : 11.14.3 : 91.3 : 22. WILM, H. G., and NIEDERHOF, C. H. **Interception of rainfall by mature Lodgepole-Pine.** *Transactions of the American Geophysical Union 1941*, Pt. 3, 1941 (660–5). [Rocky Mountain Forest & Range Exp. Sta.] P.O.

The results are given of a comparative study of rainfall interception, on virgin plots and plots receiving light, medium, heavy, or clear cuttings, in mature Lodgepole Pine forest (chief species *Pinus contorta*, *Picea engelmannii*, and *Abies lasiocarpa*) near Fraser, Colorado. Some measurements were also made of stem flow for various classes of trees. The data obtained show that all of the cutting methods resulted in augmented net rainfall, i.e. less interception, but although this influence should be in rough proportion to the intensity of treatment no clear correlation could be demonstrated in the present study. The quantity of intercepted precipitation reaching the soil as stem flow was negligible. Net rainfall was found to be strongly related to gross precipitation per storm, with initial crown-storage and evaporation rates during storms clearly expressed by the origins and slopes of regression lines. From the present analysis it would appear that most of the reductions in interception as a result of timber cutting may be attributed to reduced evaporation during storm periods.

11.62.1 : 23.3. GAMS, H. Die ökologischen und biozönotischen Voraussetzungen der Lebendverbauung. **[Ecological and biocenotic bases of conservation by means of living plants.]** *Forschungsdienst* 12, 1941 (357–61). [G.] H.S.B.

With special reference to tree planting for erosion control, etc., under Alpine conditions.

11.62.1 (729.7). HARDY, F. **Soil erosion in Trinidad and Tobago.** *Trop. Agric., Trin.* 19, 1942 (29–35). [Imperial College of Tropical Agriculture, Trinidad.]

Erosion is described for each of the main topographical divisions in Trinidad and Tobago.

11.62.11 : 23.21 : 12.25 : 44.3 : 12.21. STEAVENSON, H. A., and DODGE, A. F. **Use of Ozark White Cedar in the upper Mississippi region.** *J. For.* 40, 1942 (415–8). [Soil Conservation Service, Elsberry, Mo.]

Experience has shown that Ozark White Cedar (*Juniperus ashei*) is of little value for conservation plantings in the Upper Mississippi because of its inability to survive transplanting under normal conditions, its lack of winter hardiness, and its non-adaptability to eroded soils.

11.62.11 : 23.3 : 23.21 : 21.0 (89). TESDORFF. Kiefernwälder und Aufforstungsarten in der Provinz Maldonado. **[Pine forests and types of afforestation in the Province of Maldonado [Uruguay].]** *Z. Weltforstwirt.* 9, 1941 (62–5). [G.]

A brief report is made on dune afforestation near Maldonado, on the coast of Uruguay. *Pinus pinaster* has been the chief species used and has proved successful in the main object of dune fixation, though of too poor growth form and wood quality to be fit for anything but charcoal burning and fuelwood. Species more recently employed on suitable sites have been *Eucalyptus globulus*, *E. diversicolor*, *Robinia pseudoacacia*, *Casuarina stricta*, *Fraxinus excelsior*, and × *Populus canadensis*. Of these, the Eucalypts have done remarkably well. The oldest plantations, consisting of pure *Pinus pinaster*, date from about 1900.

11.62.11 : 23.3 (82). ARENA, A., and GUIÑAZÚ, J. R. La erosion eolica de los suelos en el centro-oeste de la Argentina: reconocimiento preliminar del efecto del viento sobre los suelos del territorio de La Pampa y zonas limitrofes. **[Wind erosion of soils in west-central Argentina: preliminary survey of the effect of wind on the soils of La Pampa and adjacent zones.]** *Publ. misc. Minist. Agric. Argent.* No. 65, 1940. pp. 71. [Span.] A.P.B.

Afforestation is included among the principal anti-erosion methods advocated for the La Pampa territory, the southwest and west of the Province of Buenos Aires, the southwest of Córdoba, and the eastern part of San Luis. Tree species especially recommended include *Eucalyptus viminalis*, *E. rostrata*, *Pinus halepensis*, and *Cupressus lambertiana*.

11.62.11 (67.8) : 60. STAPLES, R. R. **Combating soil erosion in the Central Province of Tanganyika Territory.** *E. Afr. agric. J.* 7, 1941–42 (156–65, 190–5). [Department of Agriculture, Tanganyika.]

Anti-erosion measures recommended include bush clearing on grazed land in dry areas [cf. *For. Abs.* 3 (261)] and shelterbelt planting to protect fields from wind erosion.

11.62.31 : 12.26–8 : 23.24 : 23.26. DEPPA, J. W. **Nursery-grown structural members.** *J. For.* 40, 1942 (324–6). [Soil Conservation Service.]

One-year-old, horizontally-grown cuttings of Willow, 4 ft. long, are considered the best nursery stock for building stream-bank protection works in the arroyo sites of the south-western United States. Suggestions are given for the proper handling of sprouted poles of this type.

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1. *Metabolism. Plant Constituents. Sap Flow*

12.11.11 : 12.25 : 34.26. KRESTINSKIĬ, V. N., KAZEEVA, E. V., and KOMSHILOV, N. F. **Rosin acids of the conifers. V. The structure of α-sapinic acid.** *J. appl. Chem. (U.S.S.R.)* 14, 1941 (229–38). Chem. Abs. 36 (1610-1). P.R.

12.11.11 : 12.26–8 : 12.14.5 : 34.25. TORTI, P. **Reactions of the active substance of the leaves of *Quercus robur* L. var. *sessiliflora*.** *Boll. chim. farm.* 80, 1941 (21–2). Chem. Abs. 36 (2372). P.R.

12.11.12 : 12.26–8 : 12.11.11 : 21.32. ROBINSON, W. O., and EDGINTON, G. **Boron content of Hickory and some other trees.** *Soil Sci.* 53, 1942 (309–12). [Bureau of Plant Industry, U.S.D.A.] L.S.

12.11.14 : 21.2 : 11.41.3 : 91.3. RAWITSCHER, F. Algumas noções sobre a transpiração e o balanço d'agua de plantas brasileiras. **[Some observations on the transpiration and the water régime of Brazilian plants.]** *An. Acad. brasil. Cienc.* 14, 1942 (7–36). [Port. port.e.] N.L.

An account of transpiration studies by rapid weighing under field conditions in Brazil. Species studied included *Trichomanes tenerum*, *Calonyction bonanox*, *Coffea arabica*, and *Cedrela fissilis*. The author emphasizes that the soil depth in tropical and subtropical countries may reach a maximum of 15–20 m., and considerable water reserves may be accumulated in the deeper layers of soil. During the dry period these furnish water not only to springs and streams, but also to the deeper plant roots. Large zones of humid forests in the interior of San Paulo live on these reserves during the dry period. It is suggested that the high transpiration rate of extensive humid forests must have a considerable influence on the humidity of the climate.

12.11.2. *Propagation. Growth. Development*

12.11.2 : 12.26–8 : 2. HOFFMANN, R. Untersuchungen über die Keimung und das Jugendwachstum der Schwarz- und Walnuss. **[Investigations on the germination and early growth of Black and European Walnut.]** *Forstwiss. Cbl.* 64, 1942 (59–91). [G.]

Various observations on the morphological development of young Walnut trees are included and recommendations are made regarding the pruning of crowns to eliminate undesirable crown forms. On good sites the young trees in many cases readily respond to crown pruning.

12.11.21 : 12.26–8 : 12.14.7. THIRUMALACHAR, M. J., and BASHEER AHMED KHAN, K. **Megasporogenesis and endosperm formation in *Eriodendron anfractuosum* D.C.** *Proc. Indian Acad. Sci.* 14 (Sec. B), 1941 (461–5). [Central College, Bangalore.] O.H.C.I.

12.11.22 : 12.11.15. DORAN, W. L. **The propagation of some trees and shrubs by cuttings.** *Bull. Mass. agric. Exp. Sta.* No. 382, 1941. pp. 56.

The main factors that affect the rooting response of cuttings include species, condition and time of collection of cuttings, concentrations and methods of applying root-inducing substances if used, the rooting medium, and environmental conditions while rooting. The author discusses these and other factors separately and presents a list of tree and shrub species, cuttings of which have been rooted by the methods mentioned in connexion with each.

12.11.22 : 12.11.15. MASSACHUSETTS. **Massachusetts Agricultural Experiment Station, annual report for the fiscal year ending November 30, 1940.** *Bull. Mass. agric. Exp. Sta.* No. 378, 1941. pp. 112.

Treatment with indolebutyric acid was more effective in increasing the rooting of cuttings of certain species when applied at higher than room temperatures, and again for certain species when applied in a sugar solution (2·5 per cent.) rather than in water (p. 29). In tests on the propagation of Canadian Hemlock (*Tsuga canadensis*) the most successful rooting (100 per cent. large root systems) was obtained from treatment with indoleacetic acid 15 mg./100 c.c. for 16 hours at 65° F. (pp. 82–3).

12.11.22 : 12.25 : 12.11.15. DEUBER, C. G. **The vegetative propagation of Eastern White Pine and other five-needled Pines.** *J. Arnold Arbor.* 23, 1942 (198–215). [Osborn Botanical Laboratory, Yale University.]

Cuttings from *Pinus strobus* trees 2–6 years old possessed considerable natural ability to root. With the exception of a few trees 15 years old, cuttings from trees 8–90 years old rooted only occasionally and in low percentages or not at all. Treatment of the cuttings of young stock with indolebutyric or α-naphthaleneacetic acid in talc dusts or in aqueous solutions hastened and increased the rooting responses. Similar treatments of cuttings from older trees were somewhat effective in a few collections but not consistently so. Indolebutyric acid in lanolin paste or lanolin emulsion was generally unsatisfactory. Ends of toothpicks saturated with alcoholic solutions of indolebutyric or α-naphthaleneacetic acid and inserted in the bases of cuttings made from branch terminal shoots of 6-year-old trees were effective in inducing root formation. Similar treatment of cuttings from lateral shoots of older trees generally produced injury. Supplying sucrose to the cuttings, with or without auxin, did not appreciably influence root formation. Placing the cuttings in solutions of ammonium sulphate, sodium nitrate or urea, did not increase root formation. Sodium nitrate was favourable to callus development while ammonium sulphate was slightly injurious. Cuttings from Eastern White Pine hedges pruned annually did not root as satisfactorily as those from normal trees of the same age. Some evidence of clonal variation in rooting ability was found among various collections of cuttings from individual trees. Dipping the bases of cuttings in an organic sulphur fungicide gave the most satisfactory protection against decay. The dormancy-breaking chemicals ethylene chlorhydrin and thio-urea were not effective in forcing the development of buds or roots.

Cuttings from adult trees of *Pinus parviflora*, *P. flexilis*, *P. koraiensis*, *P. peuce*, *P. cembra* and *P. lambertiana* did not root. Low rooting occurred in one collection of cuttings from one tree of *P. monticola*. The shade shoots of a *P. cembra* tree 12 years old rooted considerably better than sun shoots. *From author's summary.*

12.11.22 : 12.25 : 21.61. DEUBER, C. G. **Plagiotropic habit of growth in Norway Spruce.** *Science, N.Y.* (*n.s.*) 95, 1942 (301). [Yale University.] L.S.

Rooted cuttings from lateral twigs of Norway Spruce sometimes develop new terminal shoots that deviate from the vertical. Such plagiotropic growth was evident in 19·4 per cent. of 650 cuttings from 26-year-old trees and in 14·4 per cent. of 600 cuttings from 40-year-old trees. Subsequent observation, however, showed that by the end of the first growing season the plagiotropic habit became less evident, giving way in the second year to normal vertical growth. It is believed that the plagiotropism in early stages is not a serious obstacle to the use of vegetative propagation for this species.

12.11.22 : 12.26–8 : 12.11.15. STOUTEMYER, V. T., O'ROURKE, F. L., STEINER, W. W., and GILES, W. L. **Vegetative propagation of Black Locust.** *Amer. Nurseryman* 75 (9), 1942 (7–9). [Bureau of Plant Industry, U.S.D.A.]

Methods that may be used for the vegetative propagation of Black Locust include sucker sprouts, root cuttings, hardwood cuttings, greenwood cuttings, and grafting. The relative value of each method and the best procedure to be followed in its application are noted.

12.11.3. *Heredity. Breeding. Hybridization. Races and Questions of Provenance*

12.11.3. DEVOTO, F. E. Las hibridaciones entre especies forestales y sus frecuentes hibridaciones

naturales en nuestro pais. (Un híbrido artificial entre '*Chorisia insignis*' y '*Chorisia speciosa*'.) **[Hybridization between forest species and their frequent natural hybridization in our country. (An artificial hybrid between *C. insignis* and *C. speciosa*).]** *Physis, B. Aires* 18, 1939 (369–74). [Span.] Li.U.

Mention is made of different natural and artificial forest-tree hybrids observed by the author in a tour of Europe. These include several varieties of hybrid Poplars immune to *Napicladium tremulae* obtained by Giacometti in Turin and introduced into Argentina, among which two are also immune to *Melampsora*. In the Paraná delta natural hybrids of *Salix humboldtiana* × *S. babylonica* have been found and the same cross has been successfully effected artificially. In the Sierra de Córdoba *Juglans* sp. × *J. regia* natural hybrids have been found and have proved resistant to *Pseudomonas juglandis*; the seed parent was a species introduced from Peru and thought to be allied to *J. neotropica* Diels., a composite species. Other interspecific hybrids reported are *Eucalyptus globulus* × *E. viminalis* and hybrids have been produced artificially of *Chorisia insignis* × *C. speciosa* and *Bauhinia variegata* Linn. × *B. forficata* Link. var. *candicans* (Benth.) Hassl. The desirability of establishing a forestry research institute and of intensifying the study of forest genetics is urged.

12.11.3. GOODSPEED, T. H., and BRADLEY, M. V. **Amphidiploidy.** *Bot. Rev.* 8, 1942 (271–316). [University of California.]

12.11.3. TROMBETTA, V. V. **The cytonuclear ratio.** *Bot. Rev.* 8, 1942 (317–36). [Smith College.]

12.11.3. WETTSTEIN, W. VON. Über den gegenwärtigen Stand der forstlichen Pflanzenzüchtung. Ein Rückblick und Ausblick. **[On the present position of forest plant breeding. Retrospect and outlook.]** *Allg. Forst- u. Jagdztg.* 118, 1942 (128–31).

Brief notes on past and present methods in forest genetics. Twenty references are cited.

12.11.3 : 12.11.21 : 23.23.15. LAMMERTS, W. E. **Embryo culture an effective technique for shortening the breeding cycle of deciduous trees and increasing germination of hybrid seed.** *Amer. J. Bot.* 29, 1942 (166–71). [Div. of Subtropical Horticulture, University of California, Los Angeles.] O.B.D.

Embryo culture, as compared with usual stratification methods, results in a much higher percentage of germination in most Apricot and Peach crosses. Many abortive embryos which do not respond to stratification can be successfully germinated by embryo-culture methods. Hybrid trees can be brought into flower two years from the time of cross pollination. Certain modifications in embryo-culture technique are presented. *From author's summary.*

12.11.3 : 12.14.1 GATES, R. R. **Nucleoli and related nuclear structures.** *Bot. Rev.* 8, 1942 (337–409). [King's College, University of London.]

12.11.3 : 12.25. DENGLER, A. Ein Lärchenherkunftsversuch in Eberswalde. **[A Larch provenance experiment at Eberswalde.]** *Z. Forst- u. Jagdw.* 74, 1942 (152–79). [G.g.]

An account is given of investigations on 7- to 9-year-old trees of seven provenances of European Larch grown on sandy soils. Two Sudeten provenances and one from Silesia gave the best height growth; the growth was slightly less in a Polish provenance, and in trees of uncertain race (seed collected in Schlitz in Hessen), lower still in a Wiener Wald provenance, and lowest of all in one from Upper Styria. The stem form was good in all the provenances but best in the Wiener Wald. Two canker cases occurred, both in the Styrian race. The colour of the female flowers of the two Sudeten provenances and of the Silesian and Schlitz provenances was frequently green instead of red or rose. Variations in daily height growth were found to be correlated with temperature rather than rainfall, a surprising fact considering that local rainfall was not high and the soils were very permeable.

12.11.3 : 12.25. JENSEN, H., and LEVAN, A. **Colchicine-induced tetraploidy in *Sequoia gigantea*.** *Hereditas, Lund* 27, 1941 (220–4). [E.] [Ramlösa Plant Nurseries, Helsingborg.] E.A.G.B.

Colchicine-treated seeds of *S. gigantea* yielded two seedlings that were darker green and had coarser, more erect branches, and broader, thicker needles than the controls. One of the former was examined cytologically and proved to be tetraploid, with $2n = 44$ as against $2n = 22$ in the control. In spite of the difficulty of obtaining good chromosome counts in *Sequoia* these figures were confirmed in several different fixations and are probably accurate. A list is also given of further coniferous species that have responded positively to colchicine treatments, either as injections or as seed treatments.

12.11.3 : 12.25. LUBYAKO, M. N. **Selection of fast-growing forms among local forest tree species.** *Lesnoe Khozyaystvo, Moscow* 1941 (5), (28–32). [R.] L.S.

Significant differences were obtained in the average height and diameter of progenies of different Pine trees at the age of 13 years, though there was great variation within each progeny, even the best containing over 20 per cent. of individuals having a height below the average for the worst. In another investigation, 11-year-old progenies of first-quality stands averaged 1·8 times in height and over twice in diameter as compared with those of third-quality stands. Seed should therefore preferably be collected from stands of good quality. Since hereditary differences in vigour do not become apparent in the nursery stage, selection should be carried out by planting densely and removing inferior trees in early thinnings.

12.11.3 : 12.25. MINCKLER, L. S. **One-parent heredity tests with Loblolly Pine.** *J. For.* 40, 1942 (505–6). [Appalachian Forest Exp. Sta.]

While progenies from different known mother trees of Loblolly Pine showed highly significant differences in growth and survival, no criterion for the selection of seed trees was discovered up to the time the progenies were five years old.

12.11.3 : 12.25. MUNGER, T. T. **Progress report on a study of regional races of Ponderosa Pine.** Pacific Northwest Forest & Range Exp. Sta., Portland, Ore. 1941. pp. 15.

Ten provenances from different regions and elevations in the western United States, planted in 1928–9 on six different sites in Washington and Oregon, exhibited in 1940 much the same differences in height growth as they had done in 1930 and 1935, a provenance from near Corvallis, Oregon, giving the best results.

12.11.3 : 12.25. VINCENT, G. Kurzer Beitrag zur Unterscheidung der Kiefern- und Fichtenrassen. [**Brief contribution to the diagnosis of races of Scots Pine and Norway Spruce.**] *Forstwiss. Cbl.* 63, 1941 (260–79). [G.g.]

The ratio—length of hypocotyl plus radicle/length of cotyledons—tended to be greater in Scots Pine and Norway Spruce seeds from the northern latitudes of Europe than in those from the southern latitudes, and greater in those from higher elevations than in those from lower elevations, although the total length on the embryo was greater in 'southern' and in 'lowland' than in 'northern' and in 'mountain' seed, respectively. One-year seedlings from 'northern' seed were on an average shorter than those from 'southern' seed, and had a smaller fresh weight, dry weight, N content, and ash content; on the other hand, the root/shoot ratio in terms of length, dry weight, fresh weight, N content, and ash content was greater in seedlings from 'northern' seed. In most cases seedlings from 'mountain' and 'lowland' seed resembled in the above respects those from 'northern' and 'southern' seed, respectively.

12.11.3 : 12.25. WETTSTEIN, W. VON. Unterschiede bei Nachkommen von Alpenlärchen. [**Differences in the progeny of alpine Larches.**] *Allg. Forst- u. Jagdztg.* 118, 1942 (157–61). [G.] [Kaiser-Wilhelm-Institut für Züchtungsforschung, Erwin-Baur-Institut, Müncheberg.]

In small-scale investigations with Larch seed from different altitudes and aspects of the Gschnitz valley in Northern Tyrol, seed from over 1,500 m. elevation produced, at the end of one growing season, stock having on an average about half as many needles as that grown from seed from 1,300–1,500 m. altitude. Seed from southern aspects produced stock having a higher dry-matter content than did seed from northern aspects.

12.11.3 : 12.25 : 23.26.4. UNITED STATES. **Twenty-first annual report, Southern Forest Experiment Station.** New Orleans, La. 1941. pp. 21.

A study of the effect of geographic source of seed of Loblolly Pine (*Pinus taeda*), over a period of 15 years, has shown that in that period trees from local seed were 20 per cent. taller, 25 per cent. larger in diameter, and showed 20–50 per cent. less infection from rust canker than those from seed obtained several hundred miles away. It was also found that soil conditions in a nursery may be a very important factor in determining the success of the planting in its later development, and that adverse qualities imparted by the soil may not be sufficiently apparent to influence the grading of the stock (p. 7).

12.11.3 : 12.26–8. JOHNSSON, H. Die Chromosomenzahl von *Carpinus betulus* L. [**The chromosome number of *Carpinus betulus* L.**] *Hereditas, Lund* 28, 1942 (228–30). C.G.B.

Meiosis was studied in 17 trees from different parts of Sweden and the chromosome number $n = 32$, $2n = 64$ established, in contrast to the number $n = 8$ reported by previous authors. In *C. carpinizza* and *C. tshonoskoii* $n = 8$ was found. No sign of secondary association or of other meiotic irregularities was observed in the octoploid individuals. P. S. H.

12.11.3 : 12.26–8. YABLOKOV, A. S. **Interspecific hybridization in silviculture.** *Vestnik Gibridizatsii* (*Hybridization*) 1941 (1), (39–45). [R.] C.G.B.

Data are given showing the differences in both yield and quality of wood that may be observed between different races or ecotypes of the same species grown under similar conditions, illustrating the desirability of carrying out selection among wild forest species with a view to improving their quality. Selection alone, however, and even intra-specific hybridization, are thought to be insufficient and recourse to interspecific crossing is recommended. Interspecific hybrids often display marked heterosis and greater disease resistance. The wild Russian *Populus tremula* has been crossed with other Poplar species, thereby improving its rate of growth, wood quality, type of branching and capacity for reproduction by cuttings. Hybrids with *P.* [*alba* var.] *bolleana* Lauche are specially promising; they are erect, rapid growers, producing handsome, compact, leafy, pyramidal trees, which are extremely frost resistant and reproduce well by cuttings. Even the hybrids that did not inherit the pyramidal habit of *P.* [*alba* var.] *bolleana* had more erect trunks, and more uniform lateral branches than the Aspen and were easier to trim and free from heart rot.

Hybrids of *P. alba* with *P.* [*alba* var.] *bolleana* were also fine quick-growing trees of pyramidal habit and tolerated – 7° C. without damage to leaves.

Improved hardy hazel nuts have been produced by crossing the local *Corylus avellana* with imported Barcelona nuts. P. S. H.

12.11.3 : 12.26–8 : 12.14.7. SCHREINER, E. J., and DUFFIELD, J. W. **Metaxenia in an Oak species cross.** *J. Hered.* 33, 1942 (97–8). [Northeastern Forest Exp. Sta.] L.S.

In an artificial crossing of *Quercus alba* ♀ with *Q. robur* ♂ the influence of the pollen parent delayed maturity in the hybrid acorns, which were also somewhat larger than those resulting from controlled intraspecific mating.

12.11.3 : 12.26–8 : 12.25. DENGLER, A. Bericht über Kreuzungsversuche zwischen Trauben- und Stieleiche (*Quercus sessiliflora* Smith u. *Q. pedunculata* Ehrh. bzw. *Robur* L.) und zwischen europäischer und japanischer Lärche (*Larix leptolepis* Murray bzw. *Kämpferi* Sargent). [**Report on hybridization experiments with *Quercus sessiliflora* Sm. and *Q. pedunculata* Ehrh. (*Q. robur* L.) and with *Larix decidua* Mill. and *L. kalmpferi* Sarg. (*L. leptolepis* Murr.).**] *Mitt. H.-Göring-Akad. disch. Forstwiss.* I, 1941 (87–109). [G.] *Abstr.* in *Forstarchiv* 18, 1942 (103–4). [G.]

Hybridization experiments at Eberswalde during 1930–40 have shown the existence of strong natural barriers to crossing between *Q. sessiliflora* Sm. and *Q. pedunculata* Ehrh., since only a low percentage of successful cross-fertilization was achieved. In most years this percentage was 0–2, but in 1936 *Q. pedunculata* × *sessiliflora* gave 15 per cent. and the reciprocal cross 6 per cent. success. It is believed that, in nature, hybrid acorns in a mixed stand could amount to at most 1–2 per cent. The previous view that the two species hybridize freely has resulted in the attribution of hybridity to the frequent intermediates that occur, but it is pointed out that variations in one or the other direction may be found even on the same tree and may not be good evidence of hybrid origin. A true intermediate should differ from the type throughout, and in the author's experience such forms are rare.

Larix decidua (*L. europaea*) and *L. kaempferi* (*L. leptolepis*) hybridize freely in either direction, both of the reciprocal crosses being intermediate between the parents in needle and twig colour and of faster growth, e.g. at 5 years of age the mean height of both *L. decidua* × *kaempferi* and *L. kaempferi* × *decidua* was 2·66 m. as against 1·64 m. for *L. decidua* and 1·80 m. for *L. kaempferi*. The hybrid has so far been free from canker. Large-scale breeding of hybrid Larch could be achieved without difficulty by establishing mixed stands of the parent species.

12.13. Embryology

12.13 : 12.25. BUCHHOLZ, J. T. **A comparison of the embryogeny of *Picea* and *Abies*.** *Madroño* 6, 1941-42 (156–67). [University of Illinois, Urbana.] K.

The early embryogeny of *Picea smithiana* is described with special reference to the development of the suspensor system. The embryogeny of *Abies venusta* is described and compared with other Firs, including *A. pinsapo*, and with *Picea*.

12.14. Organography. Morphology. Anatomy. Histology

12.14.1–2 : 12.11.3. DANGEARD, P. Sur les différences de taille entre chromosomes appartenant à différents tissus dans la plantule du Pin maritime. [**On differences in size between chromosomes of different tissues in the seedling of Maritime Pine.**] *C. R. des Séances Soc. Biol.* 135, 1941 (581–3). [F.] R.M.I.

Differences in size are noted between the chromosomes of the epidermis and those of other tissues, e.g. at metaphase the normal root-meristem chromosomes average about 0·8μ and those of the epidermis 0·5μ in diameter, their lengths being about 22–24μ and about 19μ respectively. The more rapid multiplication of the epidermal cells is suggested as an explanation of this phenomenon.

12.14.3. BEDDIE, A. D. **Natural root grafts in New Zealand trees.** *Trans. Proc. R. Soc. N.Z.* 71, 1941 (199–203). L.S.

A list is given of 30 species in which natural root grafting occurs, arranged according to frequency of grafting, and of 6 species in which the phenomenon is strongly suspected. Types of graft and conditions of grafting are briefly discussed. The present limited investigation indicates that root grafts are widespread in New Zealand forests.

12.14.3 : 11.4. GARIN, G. I. **Distribution of roots of certain tree species in two Connecticut soils.** *Bull. Conn. agric. Exp. Sta.* No. 454, 1942. pp. 103–67.

A report on studies of vigorous trees in 7-year-old plantations of *Pinus strobus*, *P. resinosa*, *Picea excelsa* (*abies*), *Fraxinus americana*, and *Quercus borealis maxima* on loamy sands and fine sandy loams. Some soil properties proved to be significantly different in the zones of high root concentration in comparison with those where tree roots were few or lacking, soils in the former zones being characterized by higher moisture content, loss on ignition, total nitrogen, and total exchange capacity. Small feeding roots were concentrated near the soil surface and were more numerous near the trees. Some pronounced differences existed between the five tree species in the total number of all roots and of small feeding roots, in the proportion of large to small roots, in root penetration and spread, and in the distribution of roots in the two soils and several soil horizons. Deep-rooted tree species, particularly *P. resinosa*, showed a tendency to concentrate their roots in sections of the B_1 horizon which were rich in nutrients. Root distribution in relation to roots of bordering trees has been used as a basis for the discussion of root competition in a forest stand, root development being considered to take place in four stages: free root growth, period of invasion, period of root competition, and period of release from competition. In the plantations investigated the roots of trees spread more widely than the boundaries of their crown projections, invading areas adjacent to the neighbouring trees. The stands under investigation were placed in the second stage because it was shown in the root charts that root density of small roots in the A horizon did not approach a constant; therefore the soil capacity for roots was not reached, and the period of root competition had not begun.

12.14.3 : 12.19.2 : 11.43 : 11.41.8. SCULLY, N. J. **Root distribution and environment in a Maple-Oak forest.** *Bot. Gaz.* 103, 1942 (492–517). [Dept. of Botany, University of Chicago.] O.B.D.

(i) The relationship of the Bellefontaine silt loam soil profile, with its inclusions, to the root development of native species was studied in the Maple/Oak forest at Wychwood, Lake Geneva, Wisconsin. (ii) Sixteen station types were investigated by the trench method of sampling. In six of the station types a new, square method of trenching afforded more accurate measurement of root distribution than did the rectangular trenches commonly employed. (iii) Root systems of herbaceous and woody seedlings were excavated and their relation to the upper horizons noted. Large specimens of Sugar Maple, Red Oak, and White Oak were partially excavated. (iv) Greatest concentration of the smallest roots, 0·1–1·0 mm. in diameter, was in the A_1 horizon. Larger roots did not show an increase in number per unit horizon surface below the A horizons. Greater numbers of dead roots occurred in lower horizons. (v) On root number and percentage root-area basis, horizons A_1, A_2, B_1, B_2 and C_1 generally showed successive decrease in suitability for root development. On the same basis there were marked decreases with two exceptions, of root numbers and area with successive 1-ft. increases in depth to 3 ft. (vi) Areas with sparse ground cover showed low root numbers and comparatively high percentage root areas. Stations with more abundant ground cover were characterized by larger root numbers and smaller percentage root areas. (vii) Earthworm and cicada activities, particularly the former, were important factors in the soil environment. Such activities were more or less uniform throughout the woodland. (viii) In all cubic-foot root-volume samples, the 0–8 in. level contained 80 per cent. or more of the total root volume present in the sample. When the sample lacked roots more than $\frac{1}{4}$ in. in diameter there were successive decreases in volume in passing into the 0–4, 4–8, and 8–12 in. levels. *From author's summary.*

12.14.3 : 44.2. KUMAR, L. S. S., ABRAHAM, A., and SOLOMON, S. **A technique for the anatomical study of root parasitism.** *Ann. Bot., Lond.* (*n.s.*) 6, 1942 (177–82). [Botany Dept., College of Agriculture, Poona, India.] O.B.D.

12.14.3 : 44.2 : 12.26–8. RAO, L. N. **Parasitism in the Santalaceae.** *Ann. Bot., Lond.* (*n.s.*) 6, 1942 (131–50).

[Dept. of Botany, Queen Mary College, University of London.] O.B.D.

An account is given of a study of root parasitism in *Santalum album, S. lanceolatum, Thesium wightianum, Osyris arborea, Exocarpus aphylla, Choretrum glomeratum,* and *Scleropyrum wallichianum,* with main reference to the anatomy and development of the haustoria.

12.14.5 : 12.26–8. SYLVÉN, N. Några ord om aspens heterofylli. **[Some notes on heterophylly in Aspen.]** *Svensk bot. Tidskr.* 36, 1942 (373–82). [Sw.] L.S.

A discussion, mainly from the literature, of the occurrence of different leaf types on short shoots and on vigorous shoots of young plants, sprouts, leaders, lammas shoots, &c.

12.14.5 : 12.26–8 : 12.11.3. VIGNOLO-LUTATI, F. Sulla morfologia fogliare di presunti ibridi di *Populus*. **[On the foliar morphology of presumed hybrids in *Populus*.]** *Nuovo Giornale botanico italiano* 47 (*n.s.*), 1940 (705). [It.] *Bot. Zbl.* 35, 1941 (205). R.M.I.

12.14.7 : 12.26–8 : 12.13. RAO, L. N. **Studies in the Santalaceae.** *Ann. Bot., Lond.* (*n.s.*) 6, 1942 (151–75). [Dept. of Botany, Queen Mary College, University of London.] O.B.D.

A study of the development of the floral parts, embryo sac, endosperm and embryo of *Santalum album, Thesium wightianum, Osyris arborea,* and *Scleropyrum wallichianum.*

12.19. Geographical Distribution. Plant Geography and Sociology

12.19 : 60.31. FRITSCHI, A. Pflanzensoziologische Beobachtungen in Wirtschaftswaldungen. **[Plant sociological observations in economic forests.]** *Schweiz. Z. Forstw.* 93, 1942 (55–61; 84–90). [G.]

With reference to the forests of St. Gallen and Winterthur where acid and neutral brown forest soils are occupied chiefly by Spruce, and endodynamomorphic soils bear broadleaved trees and Silver Fir.

12.19 (57). GRIN', F. O. **Vegetation of the Khenskaya forest tundra.** *Bot. Zh.* (*J. bot. Acad. Sci. RSS Ukraine*) 1 (1), 1940 (3–76). [Ukr.r.e.] K.

The region investigated lies between the Oksarka and Nadym rivers and forms a part of the southern forest tundra of the West-Siberian lowland. The soil, chiefly loamy, and podzolized under forest, is permanently frozen. The predominant formation is sparse, mostly lichenous *Lariceta.* Growth is poor, and there is an abundance of dead wood. *Piceeta* occupy only a small part of the area and are found mostly in fluvial valleys having a milder micro-climate. In addition to forest, the vegetation of the region is made up chiefly of shrubby forest tundra (*Alneta, Saliceta,* and *Nanobetuleta*), of tundra vegetation proper (*Frigorideserta* formations), and of bog-type vegetation (mainly *Sphagneto-fruticuleta*).

12.19 (7). SHREVE, F. **The desert vegetation of North America.** *Bot. Rev.* 8, 1942 (195–246). [Carnegie Institution of Washington.]

12.19 (728.3). YUNCKER, T. G. **The vegetation of Honduras, a brief review.** *Chron. bot.* 7, 1942 (26–7). [De Pauw University, Greencastle, Ind.] O.B.D.

Brief notes on the major vegetation types.

12.19 (729.6). HODGE, W. H. **The vegetation of the Lesser Antilles, a brief review.** *Chron. bot.* 6, 1941 (402–4). [Massachusetts State College, Amherst.] O.B.D.

The major floristic types are:—coastal and shore vegetation; low xerophytic vegetation; tropical rain forests of middle elevations; mossy forests of the highest volcanic peaks. Species typical of these groups are briefly noted.

12.19 (79.4). EPLING, C., and LEWIS, H. **The centers of distribution of the chaparral and coastal sage associations.** *Amer. Midl. Nat.* 27, 1942 (445–62). [University of California, Los Angeles.] L.S.

12.19 (84). CÁRDENAS, M. Aspecto general de la vegetación de Bolivia. **[General aspect of the vegetation of Bolivia.]** *Chron. bot.* 6, 1941 (452–4). [Span.] [Universidad Autónoma de Cochabamba, Bolivia.] O.B.D.

Brief notes on the chief vegetation types.

12.19 (85). WILLIAMS, L. **The phytogeography of Peru.** *Chron. bot.* 6, 1941 (406–10). [Field Museum of Natural History, Chicago.] O.B.D.

A review. The chief vegetation types are briefly characterized and a map is provided to show their distribution.

12.19 (86) : 09.7. DUGAND, A. **On the vegetation and plant resources of Colombia.** *Chron. bot.* 7, 1942 (71–5). [Instituto de Ciencias Naturales, Bogotá.] O.B.D.

A brief review discussing the major vegetational zones and plant products, and including a list of the best known of the useful timbers of the country.

12.19 (86). SCHERY, R. W. **A few facts concerning the flora of Panama.** *Chron. bot.* 7, 1942 (77–9). [Missouri Botanic Garden.] O.B.D.

With main reference to the major vegetational zones.

12.19 (86). SVENSON, H. K. **The vegetation of Ecuador, a brief review.** *Chron. bot.* 6, 1941 (446–8). [Brooklyn Botanic Garden, N.Y.] O.B.D.

The major vegetation types are described in brief and a sketch map is provided to show the chief zones.

12.19 (88). SMITH, A. C. **The vegetation of the Guianas, a brief review.** *Chron. bot.* 6, 1941 (449–52). [Arnold Arboretum, Harvard University.] O.B.D.

Description and sketch map of the chief vegetation types.

12.19 (89). GURVICH, B. R. La vegetación del Uruguay. **[The vegetation of Uruguay.]** *Chron. bot.* 6, 1941 (410–1). [Span.] [Fac. de Agronomía, Montevideo.] O.B.D.

Four types of woodland occur—riverain, savanna, mountain and maritime. The common species of each type are briefly noted.

12.19 : 12.26–8 (41.1–4). PENISTAN, M. J. **The Caledonian Pine forest.** *Quart. J. For.* 36, 1942 (59–69).

Descriptive notes on the remaining stands of Caledonian Scots Pine, including a map showing the present distribution of natural Scots Pine forest in the Highlands. It is suggested that 'both on scientific and aesthetic grounds it is highly important that the Caledonian remains should be preserved and where possible improved'.

12.19 : 12.26–8 : 21 (54.3). HEWETSON, C. E. **Observations on the ecology of *Tectona grandis* in the Central Provinces.** *Indian For.* 67, 1941 (617–29).

The main points of the ecology of Teak in the Central

Provinces are discussed and four suggestions made:— (1) The soils derived from trap rock are especially suitable to Teak and this is due to their being more moisture-retentive than those derived from sandstone or crystalline rocks. (ii) Fire protection is normally helpful to Teak in this area. (iii) The other species present in the forest play a large part in the establishment of Teak seedlings. (iv) The combination of Teak and Bamboo may be a true climatic climax, but the loose use of the words 'Teak forest' to describe a formation in which Teak trees form a varying proportion of the crop and where it is one of a number of species is dangerous to clear thinking. For the present it is better to regard forest in which Teak forms a higher proportion of the crop than usual as a seral type. *From author's summary.*

12.19.1. *Regional Floras*

12.19.1 (54.1). BISWAS, K. **The flora of the Aka Hills.** *Indian For. Rec.* (*n.s.*) *Botany* 3, 1941 (1–62). [Royal Botanic Gardens, Calcutta.]

12.19.1 (54.1) : 12.19.4 : 12.25. BOR, N. L. **The relict vegetation of the Shillong Plateau—Assam.** *Indian For. Rec.* (*n.s.*) *Botany* 3, 1942 (152–95). [Forest Research Institute, Dehra Dun.] P.R.

The broad divisions of the vegetation are evergreen forest, Pine forest and grassland. The status of each type is discussed. An anlysis of the evergreen species in three widely separated groves shows that floristically they are related. It is concluded that the evergreen forest is the climax type while the Pine forest and the grassland are seral in status. *From author's summary.*

12.19.1 (54.2). MOONEY, H. F. **Some additions to the *Botany of Bihar and Orissa.*** *Indian For. Rec.* (*n.s.*) *Botany* 3, 1941 (iii + 63–119). P.R.

Descriptions are given of about 60 species not covered in Haines' 'Botany of Bihar and Orissa' (1925) and additional notes are furnished on some other species of special interest. A list of further vernacular names is appended.

12.19.1 (73). HARLOW, W. M. **Twig key to the deciduous woody plants of eastern North America.** The Author, New York State College of Forestry, Syracuse, N.Y. 4th ed., 1941. pp. 56.

12.19.1 (77.7). AUGUSTINE, D. W. **Plants of Mahaska County Iowa.** *Proc. Ia. Acad. Sci. 1940*, 47, 1941 (135–54). L.S.

A check list.

12.19.1 (78.3). STEVENS, O. A. **The trees of North Dakota.** *Bi-m. Bull. N. Dak. agric. Exp. Sta.* 3 (5), 1941 (8–10).

North Dakota has a relatively small percentage of its area in forest. The principal native trees, on which brief notes are given, include Willows, Aspen, Cottonwood, Balsam Poplar, American Elm, Paper Birch, Hackberry, Bur Oak, Ironwood (*Ostrya virginiana*), Green Ash, Basswood, Boxelder, Western Yellow Pine, and Western Red Cedar.

12.19.1 (79.5). PECK, M. E. **A manual of the higher plants of Oregon.** Binfords and Mort, Portland, Ore. 1941. pp. 866. E.S.R. 86 (20).

12.19.1 (88) : 12.26–8. PULLE, A. [Editor.] **Flora of Suriname** (*K. Ver. Kolon. Inst. Amsterdam, Mededeel.* 30, *Afd. Handelsmus.* 11). Vol 3, No. 1, 1941. pp. 337–443. Biol. Abs. 16 (10479–80, 10482, 10502, 10504–8, 10529–32, 10535).

Various authors contribute systematic treatments, with keys, of the families Ochnaceae, Turneraceae, Quiinaceae, Caryocaraceae, Marcgraviaceae, Dilleniaceae, Linaceae, Humiriaceae, and Lythraceae, and additions and corrections are made to previous treatments of the Malvaceae, Bombacaceae, Sterculiaceae, Tiliaceae, and Melastomaceae.

12.19.2. *Forest Types*

12.19.2 (43.1–5). MEUSEL, H. Pflanzengeographische Betrachtungen über mitteleuropäische Waldgesellschaften. I. Über die pflanzengeographische Stellung des nordwestdeutschen Eichen-Birkenwaldes. **[Plant-geographical observations on central-European forest communities. I. On the status of the north-west-German Oak/Birch forest.]** *Ber. dtsch. bot. Ges.* 59, 1941 (69–82). [G.] R.M.I.

A study of the plant societies typical of the Oak/Birch forests of north-west Germany shows that no definite line can be drawn between them and forests of other tree types. The plant societies of each may overlap and intermingle, and edaphic factors play an important part.

12.19.2 (44 : 43.1–5). SCHOENICHEN, W. Waldbilder aus den Vogesen. **[Forest types of the Vosges.]** *Z. Weltforstwirt.* 8, 1941 (571–8). [G.e.] P.R.

Descriptive notes illustrated by photographs. The characteristic tree of the Vosges is Silver Fir, which in Alsace and Lorraine accounts for 58 per cent. of the coniferous area and 19 per cent. of the total forest area. Most of the Silver Fir woods contain admixtures of other species, notably Oak and Beech.

12.19.2 (499). HOFMANN, A. Die Hartlaubvegetation der ägäischen Inseln. **[The sclerophyllous hardwood vegetation of the Aegean islands.]** *Z. Weltforstwirt.* 8, 1941 (585–93). [G.e.] P.R.

Descriptive notes illustrated with photographs. The macchia of the Aegean Islands is divided into five categories: the vegetation of (1) the sandy coasts, (2) the rocky coasts, (3) the dry beds of torrents and torrent banks, (4) the hilly interior, and (5) the higher mountains. The most typical macchia showing luxurious growth is found in the hilly interior, especially in Rhodes. Here three types, viz. *Lentiscus*, *Arbutus*, and *Myrtus-Erica* may be distinguished. At best, the macchia yields some 25 cu. m. of charcoal wood per ha. when managed on a rotation of 20 years, in addition to furnishing a little timber for the making of agricultural implements. The chief economic use of the macchia is for goat grazing.

12.19.2 (67). Die forstlich wichtigen Vegetationsformationen des tropischen Afrika. **[The chief vegetational formations of Africa from the point of view of forestry.]** *Angew. Bot.* 23, 1941 (127–8). [G.] A.P.B.

Report on a lecture by Dr. Francke. The major groups distinguished are climatic and edaphic woody formations, with moist and dry types in each case. The climatic moist woody formations comprise the tropical evergreen rain forest, the tropical deciduous rain forest (the partly deciduous rain forest on the boundary of the African equatorial forest and the savanna), the montane or lower montane rain forest, the true montane rain forest (mostly with temperate climate), the tropical montane conifer/hardwood mixed forest (e.g. the 'Cedar forests' of East Africa), the

tropical montane Bamboo mixed forest, and the open tropical alpine forest. The dry formations include savannas of various types, e.g. high-grass savanna, low-grass savanna and desert-grass savanna, savanna deciduous forest and thorn forest or thorn bush. The term steppe should be restricted to temperate continental grassland formations. To the edaphic woody formations belong 'galerie', fringing and ravine forests of various types and composition, swamp and floodland forests, Mangrove forests and strand forests.

12.19.2 (71.3). DREXLER, R. V. **Forest communities of the Quetico Provincial Park of Ontario.** *Proc. Ia. Acad. Sci.* 48, 1941 (123–7). [Coe College, Cedar Rapids, Iowa.] A.P.B.

A general outline is given of the region and the forest communities met with. There appear to be two climax communities—White Pine/Red Pine and Spruce/Fir/Birch.

12.19.2 (77.2) : 12.19.4. CHAPMAN, A. G. **Forests of the Illinoian till plain of southeastern Indiana.** *Ecology* 23, 1942 (189–98). [Central States Forest Exp. Sta.]

Soils of the Illinoian till plain are in general poorly drained, with high water-holding capacity. The old-growth forests show a predominance of Beech, Sweet Gum, and Pin Oak but also contain Yellow Poplar, White Oak, Black Walnut, Black Cherry and Hard Maple, the percentage of the latter group of species varying directly with quality of drainage, increasing from the very poorly drained Blanchester silt loam to the well-drained Rossmoyne silt loam.

Succession of plant cover, beginning with the old-field herbaceous or grassy cover has three definite stages: (1) The typical upland swamp forest of Sweet Gum, Red Maple, and Pin Oak; (2) modification of the Gum/Red Maple thickets by establishment of Yellow Poplar, Black Cherry, Sugar Maple and Shagbark Hickory; (3) a composition resembling the original, brought about by development of Beech seedlings and, on the better-drained soils, White Oak, Hickory, Black Cherry, and Sugar Maple.

Microrelief to a very great extent controls the composition of the forest stands. Seedlings of Beech and mesic species, germinating on areas where the water table is at the surface, develop only shallow root systems, inadequate for survival through the summer season when the water table recedes. *From author's summary.*

12.19.2 (77.4) : 12.19.4. GRAHAM, S. A. **Climax forests of the Upper Peninsula of Michigan.** *Ecology* 22, 1941 (355–62). [University of Michigan.]

Data obtained in this study of mixed hardwood/Hemlock forests on clay and sandy clay soils indicate that the probable course of succession following a severe burn several hundred years ago was: (*a*) Invasion of burn by Aspen; (*b*) Aspen replaced by White Pine, Yellow Birch, Hemlock and Sugar Maple; (*c*) decrease of Yellow Birch and increase of Hemlock and Sugar Maple; (*d*) gradual disappearance of Pine leaving a mixed hardwood/Hemlock forest; (*e*) this would tend more and more toward a Hemlock/Sugar Maple/Basswood forest, the ultimate hypothetical climax, though its establishment may be prevented normally over extensive areas by action of wind, fire, fungi, and insects.

12.19.3. *Other Vegetation Types*

12.19.3 (79.4). HORTON, J. S. **The sample plot as a method of quantitative analysis of chaparral vegetation in southern California.** *Ecology* 22, 1941 (457–68). [California Forest & Range Exp. Sta.]

12.19.4. *Succession*

12.19.4 : 11.45.2. BILLINGS, W. D. **Quantitative correlations between vegetational changes and soil development.** *Ecology* 22, 1941 (448–56). [University of Nevada, Reno.]

12.19.4 (77.5) : 97.1 : 60 : 11.62. MARKS, J. B. **Land use and plant succession in Coon Valley, Wisconsin.** *Ecol. Monogr.* 12, 1942 (113–33).

Includes notes on the changes in the character of local forests as a result of grazing and other forms of land use.

12.2. *Special [Systematic] Botany*

12.21. Fungi

12.21 (73). BAXTER, D. V. **Some resupinate polypores from the region of the Great Lakes. XII.** *Pap. Mich. Acad. Sci. 1940*, 26, 1941 (107–21). [University of Michigan.] L.S.

Descriptions and notes on 8 polypores, including 3 new species in *Poria*. *Coriolellus cuneatus* Murr. is transferred to *Polystictus* under the same specific name.

12.21 (485). ARWIDSSON, T. Die in Schweden beobachteten Arten von *Pucciniastrum* Otth. und verwandten Uredineengattungen. **[The Swedish species of *Pucciniastrum* Otth. and related genera of the Uredineae.]** *Svensk. bot. Tidskr.* 36, 1942 (100–7). [G.] L.S.

12.21 (485). LAGERBERG, T. Ett fynd av *Merulius sclerotiorum* Falck. **[Discovery of *Merulius sclerotiorum* Falck. in Sweden.]** *Svensk bot. Tidskr.* 36, 1942 (1–8). [Sw.] L.S.

M. sclerotiorum is recorded for the first time in Sweden on a rotted Pine plank among the remains of a former fence at Stocksund. The literature of the species, which appears to be comparatively inactive as a wood-destroyer, is discussed.

12.21 (485). NANNFELDT, J. A. **Contributions to the mycoflora of Sweden. 6. On some white-excipled lignicolous or corticolous species of *Lachnum* Retz. ex Karst.** *Svensk bot. Tidskr.* 36, 1942 (287–300). [E.] L.S.

12.25. Gymnosperms

12.25. DREES, E. MEIJER. **The genus *Agathis* in Malaysia.** *Bull. Jard. bot. Buitenzorg*, Sér. 3, 16, 1940 (455–74). [Forest Exp. Sta., Buitenzorg.] N.H.M.

In this paper are given a key to and description of the Malaysian *Agathis* species. Four new species are described:—*A. latifolia*, *A. hami*, *A. beckingi*, and *A. enderti*.

12.25. HILLIER, E. L. **The newer Asiatic Silver Firs and their characteristics described from British-grown specimens.** *J.R. hort. Soc.* 66, 1941 (400–11, 431–43). E.M.B.

Notes on and descriptions of *Abies spectabilis* and its var. *brevifolia*, *A. fabri*, *A. forrestii*, *A. georgei*, *A. faxoniana*, *A. fargesii*, *A. sutchuensis*, *A.* sp. (Kingdon Ward 7634), *A. chensiensis*, *A. ernestii*, *A. recurvata*, *A. holophylla*, *A. gamblei*, *A. kawakamii*, *A. squamata*, and *A. koreana*.

12.25 (79.4). MASON, H. L. **The Alaska Cedar in California.** *Madroño* 6, 1941–42 (90–1). [University of California.] K.

Chamaecyparis nootkatensis (Lamb.) Spach. has recently been collected from Mount Emily, Siskiyou County, California.

12.25–9 (728) : 12.19.1. WOODSON, R. E., and SCHERY, R. W. **Contributions toward a flora of Panama. V. Collections chiefly by Paul H. Allen, and by Robert E. Woodson, Jr. and Robert W. Schery.** *Ann. Mo. bot. Gard.* 28, 1941 (409–91). Li.U.

Includes descriptions of the following new tree species:—*Podocarpus allenii* Standley, *Cymbopetalum lanugipetalum* Schery, *Weinmannia pseudolaurina* Woodson, *Connarus allenii* Steyermark, *Zanthoxylum scheryi* Lundell, *Blakea brunnea* Gleason, *Conostegia chiriquensis* Gleason, *Meriana panamensis* Gleason, *Clavija alleni* Lundell, *Ardisia coclensis* Lundell, *A. geniculata* Lundell, *A. rigidifolia* Lundell, *A. scheryi* Lundell, *A. woodsoni* Lundell, and *Parathesis woodsoni* Lundell.

12.26-8. Dicotyledons

12.26–8. HOPP, H. **Methods of distinguishing between the Shipmast and Common forms of Black Locust on Long Island, N.Y.** *Tech. Bull. U.S. Dep. Agric.* No. 742, 1941. pp. 23. [Soil Conservation Service.]

External differences between the common form of Black Locust and an erect form known as Shipmast Locust (*Robinia pseudoacacia* var. *rectissima*), which occurs on Long Island, N.Y., are described. The latter is shown to be a distinct taxonomic variant of Black Locust, possessing definite morphological characters regardless of the site on which it grows.

12.26–8. HUTCHINSON, J. **Neglected generic characters in the family Cornaceae.** *Ann. Bot., Lond.* (*n.s.*) 6, 1942 (83–93). O.B.D.

Attention is drawn to the importance of the nature of the inflorescence as a generic character, particularly in the complex of species under *Cornus*, which is segregated on this basis into six distinct genera:—*Cornus* (sensu stricto), typified by *C. sanguinea*; *Macrocarpium*, typified by *M.* (*C.*) *mas*; *Afrocrania*, typified by *A.* (*C.*) *volkensii*, *Chamaepericlymenum*, typified by *C.* (*C.*) *suecicum*; *Cynoxylon*, typified by *C.* (*C.*) *floridum*; and *Dendrobenthamia*, typified by *D.* (*C.*) *capitata*. The requisite new combinations are made, a key to the genera is provided, and maps and figures given to show the range and characters of the segregated genera.

12.26–8. JONES, G. N. **New species of vascular plants from the Northwest Coast.** *Madroño* 6, 1941–42 (84–6). K.

Salix meleina (J. K. Henry) G. N. Jones is proposed as a comb. nov. for *S. geyeriana* Anderss. var. *meleina* J. K. Henry.

12.26–8. KELLER, A. C. ***Acer glabrum* and its varieties.** *Amer. Midl. Nat.* 27, 1942 (491–500). [Pomona College, Claremont, Calif.] L.S.

A. glabrum grows in western North America at altitudes of 200 ft. in the northwest to 10,400 ft. further south. A key is provided to varieties based on leaf and stem characteristics and geographical range, and the material for each variety is described.

12.26–8. KOTOV, M. I. ***Ulmus wyssotzkyi* Kotov sp. nov.** *Bot. Zh.* (*J. bot. Acad. Sci. RSS Ukraine*) 1 (3/4), 1940 (333–4). [Ukr.r.e.] K.

The species described is related to *U. suberosa* Moench and *U. foliacea* Salisb. It is found mostly on stony, calcareous, or granitic slopes in the south of the Ukraine and in the Rostov region.

12.26–8. PIERCE, J. H. **An evaluation of the type material of *Ochroma*, the source of Balsa wood.** *Trop. Woods* No. 70, 1942 (20–3). [New York Botanical Garden.]

From an examination of the type material it is concluded that all the characters upon which the described species of *Ochroma* have been segregated are either ontogenetic variations or ecological reactions. Since no other significant and constant morphological differences were evident in the type material, it is proposed to reduce the described species to synonymy under the oldest valid name, *O. lagopus* Sw. [Cf. *For. Abs.* 4 (21).]

12.26–8. SLOOTEN, D. F. VAN. **Sertulum dipterocarpacearum malayensium I.** *Bull. Jard. bot. Buitenzorg*, Sér. 3, 16, 1940 (430–54). N.H.M.

Genera dealt with are *Anisoptera*, *Dipterocarpus*, and *Dryobalanops*. New species described are *A. grossivenia*, *Dipterocarpus kutaiana*, *D. helicopteryx*, *D. applanata*, *D. borneensis*, *D. munda*, *Dryobalanops abnormis*, *D. javanica*, and *D. imbricata*.

12.26–8. SMITH, A. C. **A nomenclatural note on the Himantandraceae.** *J. Arnold Arbor.* 23, 1942 (366–8). [Arnold Arboretum, Harvard University.]

12.26–8 (497.1). PLAVSIĆ, S. Über neue und seltene Pflanzenformen aus Mittelbosnien. II. Aceraceae. **[On new and rare plant types from central Bosnia. II. Aceraceae.]** *Österreich. bot. Z.* 90 (3), 1941 (213–23). [G.] Biol. Abs. 16 (10549).

Critical list of varieties, forms, and subforms of *Acer obtusatum*, *A. hyrcanum*, *A. monspessulanum*, and *A. campestre* encountered near Visoko, central Bosnia, with new types in all but the third species.

12.26–8 (51 : 59.6–9). WALKER, E. H. **New and critical Chinese and Indo-Chinese Myrsinaceae.** *J. Arnold Arbor.* 23, 1942 (344–55). [U.S. National Herbarium, Washington, D.C.]

Critical notes on species of *Maesa*, *Ardisia*, *Embelia*, *Myrsine*, and *Rapanea*, supplementary to the author's revision of the eastern Asiatic Myrsinaceae [*Philipp. J. Sci.* 73, 1940 (1–258)].

12.26–8 (54 : 59.1). RAIZADA, M. B. **Five new Indian and Burmese flowering plants.** *Indian For. Rec.* (*n.s.*) *Botany* 3, 1941 (i + 121–8). [Forest Research Institute, Dehra Dun.]

New species described and figured include *Ceropegia borii* Raizada, *Bauhinia lyrata* Raizada, *Neptunia robertsonii* Raizada, *Capparis bhamoensis* Raizada, and *Phlogacanthus pochinii* Raizada.

12.26–8 (59.6–9). MERRILL, E. D. **Records of Indo-Chinese plants, III.** *J. Arnold Arbor.* 23, 1942 (156–97). [Arnold Arboretum, Harvard University.]

Critical notes on plants of many different families. New tree species are described in the genera *Ficus*, *Helicia*, *Knema*, *Pygeum*, *Gomphandra*, *Meliosma*, *Elaeocarpus*, *Vatica*, *Homalium*, *Cornus*, *Linociera*, and *Callicarpa*.

12.26–8 (67). CHEVALIER, A. Sur un arbre du Cameroun et du Gabon à bois utilisable (*Afzelia pachyloba* Harms). **[On a tree of the Cameroons and Gabon with utilizable timber (*Afzelia pachyloba* Harms).]** *Rev. Bot. appl. Agric. trop.* 19, 1940 (484–8). [F.] *Abstr.* in *Holz* 4, 1941 (290). [G.] P.R.

Afzelia zenkeri Harms and *A. brieyi* De Wild. are reduced to synonyms of *A. pachyloba* Harms. The species occurs in the Cameroons, Gabon, and in the Belgian and Portuguese Mayombe region.

12.26–8 (7) : 72 : 12.19.1. MULLER, C. H. **Notes on the American flora, chiefly Mexican.** *Amer. Midl. Nat.* 27, 1942 (470–90). [Bureau of Plant Industry, U.S.D.A.] L.S.

Descriptions of material, mainly of the genus *Quercus*, collected in northern Mexico and other sources.

12.26–8 (78.8) : 12.19.1. SMITH, E. C. **The Willows of Colorado.** *Amer. Midl. Nat.* 27, 1942 (217–52). [Colorado College of Agriculture & Mechanic Arts, Fort Collins.] L.S.

The paper includes keys to and descriptions and distribution records of the *Salix* species of Colorado. Twenty-nine species are recognized.

12.26–8 (8). KOBUSKI, C. E. **Studies in the Theaceae, XII. Notes on the South American species of *Ternstroemia*.** *J. Arnold Arbor.* 23, 1942 (298–343). [Arnold Arboretum, Harvard University.]

A key is provided to the 49 species, 16 of which are new, followed by descriptions, synonymy and distribution of each.

12.26–8 (86). KOBUSKI, C. E. **Studies in the Theaceae, XI. *Killipiodendron*.** *J. Arnold Arbor.* 23, 1942 (231–2). [Arnold Arboretum, Harvard University.]

Description of *Killipiodendron colombianum* gen. et sp. nov., a tree of the Cordillera Oriental, Dept. Huila, Colombia.

12.26–8 (86) : 31.0 : 23.21. DUQUE, J., J.M. Meliaceas colombianas. **[Colombian Meliaceae.]** *Tierras y Aguas, Bogotá* 3 (21; 22), 1940 (27–32; 3–10). [Span.] *Trop. Woods* No. 70, 1942 (39).

An account of species of *Cedrela, Guarea*, and *Swietenia*, with reference to their botanical characters, properties and uses of their woods, and possibilities for commercial planting. A note is appended on Palisandro or Cocobolo (*Dalbergia retusa* Hemsl.), which is said to grow along the coast of Chocó.

12.26–8 (86) : 31.21.2. DUGAND, A. Una nueva Lecitidácea colombiana. **[A new Colombian species of the Lecythidaceae.]** *Caldasia, Bogotá* 3, 1941 (31–2). [Span.] *Trop. Woods* No. 70, 1942 (39).

Grias foetidissima Dugand, sp. nov., is a tree 20–25 ft. high, found in rain forest along the Río Orteguaza, Comisaría de Caquetá, Vencia, Colombia. The wood has a strong fetid odour.

12.26–8 (95). ALLEN, C. K. **Studies in the Lauraceae, IV. Preliminary study of the Papuasian species collected by the Archbold expeditions.** *J. Arnold Arbor.* 23, 1942 (133–55). [Arnold Arboretum, Harvard University.]

Includes descriptions of 22 new species of *Cryptocarya*, 9 of *Endiandra*, 2 of *Cassytha*, and *Brassiodendron fragrans* gen. et sp. nov.

12.26–8 (95). CROIZAT, L. **New species of *Croton* L. from New Guinea.** *J. Arnold Arbor.* 23, 1942 (369–76). [Arnold Arboretum, Harvard University.]

Descriptions are given of 10 new species, all trees or small trees.

12.26–8 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae, IX.** *J. Arnold Arbor.* 23, 1942 (233–65). [Arnold Arboretum, Harvard University.]

The genera dealt with are *Decaspermum, Myrtus, Xanthomyrtus, Eugenia, Acmena* and part of *Syzygium*. New species are described in all genera except *Acmena*.

12.26–8 (95). MERRILL, E. D., and PERRY, L. M. **Plantae Papuanae Archboldianae, IX.** *J. Arnold Arbor.* 23, 1942 (267–97). [Arnold Arboretum, Harvard University.]

Includes descriptions of a large number of new species in the genus *Syzygium*.

12.26–8 (96.1–8). BAILEY, I. W., and SMITH, A. C. **Degeneriaceae, a new family of flowering plants from Fiji.** *J. Arnold Arbor.* 23, 1942 (356–65). [Biological Laboratories, Harvard University.]

The new family is represented by *Degeneria vitiensis* gen. et. sp. nov., a Fijian tree from Viti Levu and Vanua Levu. Morphological and anatomical characters are discussed, and distinctions from other families in the Magnoliales are emphasized.

12.26–9 (54 : 59.1). BOR, N. L. **New Indian and Burmese species.** *Indian For. Rec.* (*n.s.*) *Botany* 3, 1941 (i + 144–50). [Forest Research Institute, Dehra Dun.]

New species described and figured include *Eragrostis theinlwinii* Bor, *Dicliptera minbuensis* Bor, *Kayea sukoena* Bor, and *Deyeuxia simlensis* Bor.

13.1. *General Zoology*

13.15 : 13.2 : 07.7. ADAMSON, A. M. **Laboratory technique for the study of living termites.** *Ecology* 22, 1941 (411–4). [Imperial College of Tropical Agriculture, Trinidad.]

13.15 : 13.2 : 45.3. JAHN, E. Über Parthenogenese bei forstschädlichen *Otiorrhynchus*-Arten in den während der Eiszeit vergletscherten Gebieten der Ostalpen. **[On parthenogenesis in species of *Otiorrhynchus* harmful to forests in regions of the Eastern Alps covered with ice during the glacial period.]** *Z. angew. Ent.* 28, 1941 (366–72). [G.] R.A.E. A30 (246).

Records of parthenogenesis among species of this genus in Europe are briefly reviewed. During investigations in the Eastern Alps the author observed that certain species were represented in limited areas by females only and in others by both sexes. The districts where only females occurred had almost all been covered with ice during the glacial period. The species observed were *O. chrysocomus* Germ., *O. scaber* L. and *O. salicis* Ström, which are forest pests, and *O. chalceus* Stierl. For each of these are given the local distribution of the females only and of the two sexes together.

13.2. *Special [Systematic] Zoology*

13.2 : 45.3. SZELÉNYI, G. VON. Über die Chalcididen-Gattung *Pachyneuron* Walk. (Hymen.). **[On the Chalcid genus *Pachyneuron* Walk. (Hym.).]** *Cbl. gesamte Forstw.* 68, 1942 (93–105). [G.]

A summary of literature data on the genus with a description of *P. pruni* Walk. and *P. grande* Thoms.

2. SILVICULTURE

2 : 12.19 : 13.15. BALDWIN, H. I. **The biological task of forestry.** *Repr.* of paper read at the Fifth Annual Agricultural Conference of Bio-Dynamic Farming and Gardening Assn., Inc., Phoenixville, Pa. Feb. 2, 1941. pp. 12. [New Hampshire Forestry & Recreation Department.]

The importance of considering the forest from the biological viewpoint is emphasized—the interactions of all forms of life within the forest unit and particularly the biological aspect of soil fertility and development. The effect of burning, cutting, planting pure conifers, and forest grazing on soil fertility and forest production are discussed and measures that lead to optimal forest productivity are noted. These include the use of mixed stands, frequently recurring light cuttings, natural regeneration, scattering slash, maintenance of conditions favourable to wild life, and elimination of forest grazing.

2 : 12.19 : 13.15 (74). SPURR, S. H., and CLINE, A. C. **Ecological forestry in central New England.** *J. For.* 40, 1942 (418–20). [Harvard Forest, Petersham, Mass.]

Cutting practices in the forests of central New England in the past have been wasteful and the present condition of the forests is unsatisfactory from both the economic and biological viewpoints. Silvicultural treatment designed to improve the forest composition and form is desirable. It is pointed out that there is a choice in the method to be adopted, depending on the type of forest desired, of which there are three main groups: (1) Artificial types—stands of exotics or of native species in unnatural composition or on unnatural sites—have had little success in the past, a high risk and high costs are involved in their production, and forest practices leading to their establishment cannot be recommended. (2) Temporary natural types are difficult to maintain and practices aimed at their perpetuation usually involve extreme exposure of the site and will be generally unprofitable. (3) Near-climax natural types, which consist in general of a mixture of both tolerant hardwoods and conifers, are by far the most desirable from the economic viewpoint, and when once established they are easily maintained by relatively light cuttings which have advantages with respect to site, composition and cost. These types are less subject to attack by diseases and insects and less susceptible to loss from windthrow. Low-cost production of late successional natural forest types is particularly desirable at present in central New England where the possibility of damage by ice storms and hurricanes and the temporary nature of the present timber market make large investments in silviculture extremely risky.

2 : 12.25 : 12.26–8 : 57.0 : 44.3 : 60.3 : 90 (51). TENG, S. C. **Studies of Chinese timber trees in reference to forest management. I.** *Sinensia* 11, 1940 (363–95). [E.chin.] L.S.

Silvicultural and growth data are given for *Pinus yunnanensis*, *P. armandi*, *Larix potanini*, *Picea likiangensis*, *Abies georgei*, *Quercus semicarpifolia*, and *Betula albo-sinensis*. Brief discussions are also included on diseases and rot fungi, management, and silvicultural policy. The forests studied are in northwestern Yunnan and southeastern Sikang.

2 : 12.25 : 47. FRÖHLICH, J. Die Tanne in Südosteuropa. **[Silver Fir in southeastern Europe.]** *Cbl. gesamte Forstw.* 68, 1942 (81–91). [G.]

General notes on distribution, growth, and silviculture.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

21.0. *Adaptability to the General Environment. Acclimatization*

21.0 : 12.25. BARBEY, A. Biologie du mélèze en plaine. **[Biology of Larch in the plains.]** *J. for. suisse* 93, 1942 (113–7). [F.]

Note on a 70-year-old Larch stand in the Seyte forest, Concise district, at an elevation of 480 m. The stand was obtained by natural regeneration from parent trees of unknown seed origin. It shows remarkably fine growth and the quality of the timber is excellent.

21.0 (45). **[Exotics introduced into Italy.]** *Legno* (12), 1941 (222–7). *Abstr.* in *Z. Weltforstwirt.* 9, 1941 (57–8). [G.]

It is not possible, in the interests of other forms of cultivation, to extend the forest areas of Italy; hence the production of the present forest area must be increased, and this can be brought about only by the introduction of fresh tree species. Experiments have been conducted with 90 species and a report is furnished on their performance for the first 20 years. The species are listed according to their degree of suitability under Italian conditions.

21.0 (47.6) : 07.6. LIPA, O. L. **Supplement to the gymnosperms of gardens and parks in the Ukrainian SSR. (Data for the study of the dendroflora of the Ukrainian SSR).** *Bot. Zh.* (*J. bot. Acad. Sci. RSS Ukraine*) 1 (1), 1940 (119–26). [Ukr/r.e.] K.

A supplement to the author's 'Dendroflora of the Ukrainian S.S.R., I. Conifers', published by the Academy of Sciences of the Ukrainian S.S.R. in 1939. One hundred new records of trees and shrubs are mentioned, indicating for most the environment, growth data, and growth and fruiting characters. Species dealt with include *Ginkgo biloba*, *Abies sibirica*, *A. alba*, *A. balsamea*, *A. nordmanniana*, *A. fraseri*, *A. veitchii*, *A. concolor*, *Pseudotsuga taxifolia*, *Tsuga canadensis*, *Picea abies*, *P. orientalis*, *P. canadensis*, *P. pungens*, *P. engelmanni*, *P. omorica*, *P. jezoensis*, *Larix kaempferi*, *L. sibirica*, *L. decidua*, *Pinus contorta*, *P. ponderosa*, *P. rigida*, *P. sibirica*, *P. excelsa*, *P. strobus*, *Thuja occidentalis*, *T. plicata*, *Chamaecyparis lawsoniana*, *C. pisifera*, *Juniperus sabina*, *J. virginiana*, and *J. communis*.

21.0 (82) : 12.26–8. DEVOTO, F. E. La teca. **[Teak.]** *Mundo Maderero* 3 (25), 1942 (5–7). [Span.]

Tectona grandis was introduced by the author to Argentine in 1929. Ten-year-old trees grown in the Salta province from seed obtained in British India have shown good growth and have fruited from the age of six years.

21.0 (96.1–8) : 12.26–8 : 31.0 : 57.0. SMITH, J. S. ***Albizzia falcata.*** *Agric. J., Fiji* 12, 1941 (67). L.S.

Two-year-old trees of *A. falcata* Backer (*A. moluccana*

Miq.) are often 30 ft. high and 6 in. in diameter, ten-year-old trees 90 ft. high and 24 in. in diameter, and a 6½-year-old tree in Ceylon was 89 ft. high and 6½ ft. in girth. The wood is white, soft and light, and has been used in Java for the manufacture of cheap matches. It is suitable for short-lived products such as fruit cases, but has a disagreeable odour that might be a disadvantage for products such as butter boxes; a further possible use is for paper-making but the pulp is of low quality. Experimental plantations have been made in Fiji to ascertain the possibility of growing *A. falcata* as a wood for fruit cases. It is thought possible, however, that the shallow rooting habit of the species may render it insufficiently wind-firm for this region. Owing to its light crown and fast growth, it has been widely used in the East Indies as a shade tree for coffee and tea. It should not, however, be planted near wells, as its roots are said to taint the water.

21.0 (96.1–8) : 12.26–8 : 57.0. PARHAM, W. L. ***Albizzia falcata*—a quick growing tree.** *Agric. J., Fiji* 12, 1941 (67–8). L.S.

Seed of *A. falcata* was sown at stake on the Waimaro Demonstration Farm, Fiji, in 1938, the sowing being made early in the year in 4 rows at 8-ft. spacing on an exposed hill denuded of soil. Maintenance was restricted to the cutting of grass. In May, 1941, girth measurements were taken at 4 ft. 6 in. from ground level. The maximum girth was 32 in., the minimum 6 in., and the average for 33 trees, 22 in. Nine trees had been broken by a hurricane in February, 1941, but in no case was any tree uprooted. Immature seed pods were found after the hurricane and local supplies of seed should soon be available.

21.1. *Light and Temperature Requirements*

21.12 : 42 : 23.27 (74.7). CORNMAN, J. F. **The winter hardiness of some ornamental woody plants in New York State.** *Bull. Cornell agric. Exp. Sta.* No. 772, 1941. pp. 32.

21.8. *Phenology*

21.8 : 12.25 : 12.11. LANGLET, O. Några iakttagelser över vinterfärgningen hos tall, *Pinus silvestris* L. **[Some observations on winter coloration in Pine, *Pinus sylvestris* L.]** *Svensk bot. Tidskr.* 36, 1942 (231–42). [Sw.g.] L.S.

From the investigations reported it appears that the winter coloration observed in the northern provenances of Pine in Sweden is conditioned by a decrease in the chlorophyll content and the chlorophyll/carotenoids ratio, the formation of yellow colorants insoluble in ether, which have not been analysed so far, and a rearrangement or disintegration of the chloroplasts. The winter colour of the Pine needles resembles the autumn colour of deciduous broadleaved trees.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.11 : 23.1. **Patch logging encourages natural restocking.** *B.C. Lumberm.* 26 (4), 1942 (28–9).

Improved natural regeneration has followed the use of patch logging on Vancouver Island, where clear-cut areas, varying in size but of less than 400 acres, are interspersed with blocks of timber. This method also reduces the fire hazard, isolates the risks and gives better control of spring and early fall burning. Truck logging, with its more or less permanent system of roads, is well suited to this method.

22.14.1 : 09.1. REINHOLD, G. Beiträge zur Geschichte des Plenterwaldes bis zum Beginn des 19. Jahrhunderts. **[Contributions to the history of selection forest up to the beginning of the 19th century.]** *Allg. Forst- u. Jagdztg.* 118, 1942 (81–92). [G.]

22.14.2 (79.1 : 78.9 : 76.4). PEARSON, G. A. **Logging improves old cut-over areas in the Southwest.** *Timberman* 43 (8), 1941–42 (18, 32). [Southwestern Forest & Range Exp. Sta.]

Yellow Pine areas in Arizona that were originally cut over 40–60 years ago under a practice known as 'loggers' selection', have restocked and in some cases are being cut a second time. Data on amount cut, reserve stocking, increment and defect are given for one such stand and are compared with data from a 30-year-old Forest Service cutting.

22.14.2 : 12.19.2 : 12.25. DAY, M. W. **Selective cutting well adapted to Spruce-Fir forests.** *Quart. Bull. Mich. agric. Exp. Sta.* 24, 1942 (238–40). [Dunbar Forest Exp. Sta.]

Results from experimental cuttings of different intensities in second-growth Spruce/Fir forests in Michigan indicate that the selection method of cutting is well suited to this type. The degree of cutting to be applied to a particular stand will vary with volume and composition of original stand, amount and suitability of young growth present, and exposure of site.

22.14.2 : 12.25. RAPRAEGER, E. F. **Possibilities of partial cutting in young Western White Pine.** *Sta. Pap. Nth. Rocky Mt. For. & Range Exp. Sta.* No. 2, 1940. pp. 19.

Discussion of the technique of applying light intermediate cuts in young stands of Western White Pine (*Pinus monticola*), of the advantages of this method over clear cutting, and of the silvicultural and economic factors which influence its applicability. Partial cutting maintains stand conditions favourable to the natural suppression of *Ribes*.

22.14.2 : 12.25 : 32.1. BRUCE, D. **Maturity selection: a practical method of marking Ponderosa Pine under the maturity selection system.** *Timberman* 43 (8), 1941–42 (20, 22, 26, 32).

Description of a method for marking Ponderosa Pine under the maturity selection system, based on tree diameter, tree class according to the Keen classification, and the grade of the lowest logs in the tree.

22.14.2 : 12.25 : 66 : 7. MUNGER, T. T., and BRIEGLEB, P. A. **Recent developments in Pine silviculture.** *Nthwest. Sci.* 16, 1942 (40–5). [Pacific Northwest Forest & Range Exp. Sta.] A.P.B.

A brief review is made of the advantages of the maturity selection system [cf. *For. Abs.* 3 (42)] from the points of view of silviculture, management, and economics. A few examples are quoted to show the trend towards lighter cutting of Ponderosa Pine in Oregon and Washington, on both private and public lands.

22.14.2 : 76.1 : 12.25 : 33.02. BELOTELKIN, K. T., REINEKE, L. H., and WESTVELD, M. **Spruce-Fir selective logging costs.** *J. For.* 40, 1942 (326–36). [Northeastern Forest Exp. Sta.]

Detailed analysis of cost studies in three types of operation in a 65-year-old Spruce/Fir stand in northeastern United States—partial cutting for peeled pulpwood, partial cutting for rough pulpwood, and clear

cutting for rough pulpwood. It is shown that in logging with horses in partial cuttings removing 10–60 per cent. of the stand the costs do not exceed those from clear cutting and it appears that selective cutting will become definitely cheaper than clear cutting as experience is gained.

22.6 : 22.82 : 12.25 (43.1–5). PASCHEN, K. Altersklassenmischung in einem Kiefernrevier 4. Klasse. **[Mixture of age classes in a fourth-quality Scots Pine district.]** *Forstarchiv* 18, 1942 (136–46). [G.]

Owing to the failure to establish broadleaved trees in pure or mixed stands on the dune sands at Kaliss, Mecklenburg, present attempts are directed towards a mixture of age classes of Scots Pine. Each class is distributed over several plots of 1–2 ha. in size, located at some distance from one another. Aesthetic and other advantages of this arrangement are discussed.

22.82 : 22.83 : 57.0. BURGER, H. Beitrag zur Frage der reinen oder gemischten Bestände. **[Contribution to the question of pure or mixed stands.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 22, 1941 (164–203). [G.g.f.]

Comparative studies were made at six localities in Switzerland on pure and mixed stands grown under similar conditions. The stands comprised chiefly Beech, Spruce and Larch, pure or in mixture, and Silver Fir and Pine in mixture with Beech and Spruce. For the same species and age, the diameter distribution was much the same whether the trees were grown pure or in mixture, and the height was sometimes greater in the one case and sometimes in the other. The bole of Beech tended to be shorter and less straight when the trees were grown in mixture with conifers. The conifers also tended to be less straight when grown in mixture with broadleaved trees of the same age, notably on good hardwood soils.

22.83 (77.4) : 22.89 : 23.21 : 23.24 : 21.0 : 57.0. YOUNG, L. J. **The growth and development of a mixed-conifer plantation.** *Pap. Mich. Acad. Sci. 1940*, 26, 1941 (153–8). [University of Michigan.] L.S.

The plantation discussed was established in 1903 on light glacial outwash sand on a tract near Negaunee, Michigan, which was then covered with dense grass but had originally borne White Pine and other species of unknown identity. Planting was done at a spacing of 6 ft. in furrows ploughed at about the same intervals. With one exception the species used—including Scots Pine, White Pine, Red Pine, Norway Spruce, and Douglas Fir—were planted in pure strips of various width and arrangement. From growth data extending to 1938 it is concluded that:—(i) A stripwise mixture is inadvisable unless the species on adjacent strips have very similar rates of height growth on the particular site. The effects of disparity in height growth are worse on narrow strips. (ii) The particular mixture employed has not prevented serious damage to White Pine by the tip weevil. (iii) Under present conditions, planting of White Pine in this locality will not be profitable. (iv) Care must be taken to ensure that Scots Pine seed is from a suitable source. (v) Except on areas dominated by Pine, Norway Spruce has made satisfactory growth and has been free from appreciable damage. (vi) Red Pine has excelled the other species in every respect. (vii) The stock and planting method used gave adequate stocking, except of White Pine. (viii) Disregarding quality, wood production has been good, the average for the last 5 years being 1·196 cords per acre per year on the basis of 100 cu. ft. of wood per standard stacked cord.

23. FORMATION OF STANDS

23.1. *Natural Regeneration*

23.1 : 12.25 (79.4). BAKER, F. S. **Reproduction of Ponderosa Pine at low elevations in the Sierra Nevada.** *J. For.* 40, 1942 (401–4). [University of California, Berkeley.]

In the northern part of the Sierra Nevada, between 1,200 and 2,000 ft. elevation, there is a belt in which Ponderosa Pine grows well but where reproduction of this species is difficult and uncertain except on recently disturbed mineral soil free of root competition. Poor reproduction is due basically to drought and also to competition from grass, brush (chaparral species established following fire) and trees. The only economically feasible method of improving conditions at present is to suppress and kill out the brush by maintaining dense stands of Pine wherever possible and then securing reproduction by some standard silvicultural method that permits its establishment and frees it from competition with the parent stand.

23.1 : 12.26–8 (410). BOURNE, R. **A note on Beech regeneration in southern England.** *Quart. J. For.* 36, 1942 (42–9).

A brief discussion of the conditions required for successful natural regeneration. The object of the note is to warn foresters in charge of Beech woods to prepare in time for the heavy mast expected to occur in 1944 or 1945.

23.13 : 12.25. KRAUCH, H. **Scarifying soil to promote natural regeneration in Douglas-Fir cut-over stands shows no marked benefit.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 101, 1942. pp. 2.

Some benefit was obtained from the treatment but not sufficient to justify its extended application.

23.13 : 12.25 : 45.12 : 13.2. KRAUCH, H. **Successful natural regeneration of Douglas-Fir cut-over stands is dependent on effective control of rodents.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 97, 1942. pp. 2.

It is concluded that in the region of New Mexico in which this study was made, the successful regeneration of Douglas Fir cut-over stands depends on a good supply of seed and on the effective control of mice.

23.2. *Artificial Regeneration*

23.2 (54.1) : 24 : 21. DE, R. N. **Nursery and plantation notes for Assam.** *Publ. Assam For. Dep.* No. 10, 1940. pp. 48.

Includes notes on locality, silvicultural characteristics, nursery requirements and rate of growth for 41 tree species that have been or are likely to be introduced into plantations in Assam.

23.2 : 12.19.2 (54.8) : 33.06. GRIFFITH, A. L. **Investigations into artificial regeneration details of the dry fuel forests of Madras.** *Indian For. Rec. (n.s.) Silviculture* 4, 1941 (iv + 161–223).

The present paper provides the experimental justification for a number of opinions expressed in a record already published [cf. *For. Abs.* 2 (208)]. The experimental work consisted of 222 small-scale experiments which were made at Chittoor and Emmanur during 1932–9 at an elevation of about 1,100 ft. with a dry hot

climate and an annual rainfall of 29 in. This precipitation is from the north-east monsoon and is very variable in both season and quantity. The general conclusions are:—

(1) Direct sowing is in general the best method of regeneration for dry fuel forests. Exceptions are *Holoptelea integrifolia*, which should be transplanted, and *Dolichandrone crispa*, *Soymida febrifuga*, and *Hardwiekia binata*, which should be stump planted.

(2) Direct sowing should be done in late June or early July, resowing if necessary at intervals of three or four weeks until full stocking is obtained. This is necessary in order that the great advantages of the best date of sowing should not be missed. This best date varies from year to year but is usually between late June and early August.

(3) The early rain of the north-east monsoon is the most suitable time for both transplanting and stump planting. This is usually in late September or early October.

(4) Two-year-old stumps give better results than one-year-old stumps.

(5) Both burning and soil working before sowing are beneficial.

(6) Soil working after germination by forking between the rows produces substantial increases in both survival percentage and mean height growth. Its effect is greatest in backward crops and for these it should be regarded as essential.

23.21. Choice of Species

23.21 (86) : 21.0. DUQUE, J., J.M. Arboles del vivero de Bogotá. **[Trees in the Bogotá nursery.]** *Tierras y Aguas, Bogotá* 3 (18), 1940 (26–36). [Span.] *Trop. Woods* No. 70, 1942 (39).

Various native and exotic tree species, of the genera *Cedrela*, *Juglans*, *Casuarina*, *Acacia*, and *Cupressus*, are considered with reference to their value for forest plantings in the uplands of Colombia.

23.23. Sowings

23.23.1. *Seed Procurement, Treatment, and Testing*

23.23.1 : 12.26–8 : 12.11.21. HEIT, C. E. **Field germination and propagation of various hardwoods.** *Notes For. Invest.* No. 43, 1942. pp. 2. [Conservation Dept., New York.]

Techniques giving the best field germination are noted for each species. 1. Red Oak (*Quercus rubra*)—fall-sown seed or spring-sown seed that had been stratified in peat moss or sand at about 4° C. Highest tree per cent. was usually obtained with spring-sown seed that had been properly after-ripened for 2½–3 months. 2. European Oak (*Q. robur*)—fall-sown seed heavily mulched with leaves. 3. Shagbark Hickory (*Carya ovata*)—six or seven months' stratification in peat moss at 4° C., or at room temperature for two months followed by five months at 4° C. prior to spring sowing. 4. Bitternut Hickory (*C. cordiformis*)—fall-sown seed heavily mulched with leaves. 5. Black Walnut (*Juglans nigra*) and Butternut (*J. cinerea*)—similar to Shagbark Hickory. 6. Catalpa (*Catalpa speciosa*)—dry-stored seed sown in the spring. 7. European Mountain Ash (*Sorbus aucuparia*)—seed macerated soon after collection and sown in October.

23.23.1 : 12.26–8 : 12.11.21. HEIT, C. E. **Tulip Poplar (*Liriodendron tulipifera*) : propagation and seed data.** *Notes For. Invest.* No. 44, 1942. pp. 2. [Conservation Dept., New York.]

Maximum field germination and highest seedling production the first year were obtained by stratifying seed in moist peat moss at 36°–40° F. for 4½–6½ months prior to spring sowing. Early October sowing with a light mulch spread over the seedbed gave the best results for fall-sown seed.

23.23.11 : 12.25 : 21.8 : 12.11.21 : 11.2. ROESER, J. **The influence of climate on seed production in Douglas Fir.** *J. For.* 40, 1942 (304–7). [U.S. Forest Service.]

Observations made annually between the years 1924 and 1935 inclusive, on 23 Douglas Fir trees located at various elevations between 6,750 ft. and 9,455 ft. above sea level throughout the range of the species on the east slope of Pikes Peak (Colorado), show that weather conditions at the time of flowering influence flower production by this species. Under favourable conditions the normal percentage of setting is about 90.

Flowers are most susceptible to freezing at the time they burst from the buds but are apparently at no time immune if freezing temperatures prevail through a protracted period and are accompanied by snow. Severe hailstorms during the flowering stage may also be destructive to flowers. Exceptional combinations of weather conditions may also result in heavy spring losses of fruit, leaves and buds. *From author's summary.*

23.23.15 : 12.25. LATOUR, H. J. **Notes on the storage of Red Pine seed for 9 years.** *Notes For. Invest.* No. 38, 1942. p. 1. [Conservation Dept., New York.]

Red Pine seed stored in sealed carboys, at a constant temperature of 36°–40° F. and maintained at a low moisture content of 6 per cent. or less, showed 93·5 per cent. germination at the end of nine years. [Cf. *For. Abs.* 2 (37).]

23.23.15 : 12.25. LOEBEL, M. Ein kleiner Aufbewahrungsversuch mit Nadelholzsamen in Humus. **[A small experiment on the storage of conifer seed in humus.]** *Forstwiss. Cbl.* 1940, (237–42). [G.] *Abstr.* in *Forstarchiv* 18, 1942 (106). [G.]

Experiments on the storage of coniferous seed in Spruce humus and in humous quartz sand from a Pine stand showed that this form of storage gave only a low germination per cent. after 10 years, and after 12–13 years the germination was practically nil. There are thus no advantages in the long-term storage of conifer seed in these media, though further trials for short-term storage might be desirable.

23.23.15 : 12.26–8. HEIT, C. E. **Acid treatment of Honey Locust [seed].** *Notes For. Invest.* No. 42, 1942. p. 1. [Conservation Dept., New York.]

Seed treated with concentrated sulphuric acid for 1–2 hours at 78°–80° F. gave rapid and uniform germination after sowing.

23.23.15 : 12.26–8. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

In tests with *Terminalia chebula* seed receiving various pre-germination treatments, it was found that dry depulped seed gave the highest germination per cent. Germination per cent. and seedling height growth varied with diameter of depulped seed used, the larger seed (0·6–0·9 in.) giving best results (pp. 32–3).

23.23.15 : 12.26–8. REINEKE, L. H. **Effect of pre-germination and radicle damage on first-year development of Red Oak.** *J. For.* 40, 1942 (346–7). [North-eastern Forest Exp. Sta.]

Germination of acorns before sowing had no significant effect on development but removal of half the radicle of germinated acorns resulted in a thicker and shorter tap root.

23.23.15 : 12.26–8 : 07.7. PENEFF, N. Die Überwindung der Hartschaligkeit beim Saatgut der Robinie (*Robinia pseudacacia* L.). **[Treatment of Black Locust (*Robinia pseudoacacia*) seed to overcome 'hard-shelledness'.]** *Forstwiss. Cbl.* 63, 1941 (232–7). [G.] [Institut für Forstsamenkunde und Pflanzenzüchtung, München.]

The germination percentage of the seed was increased considerably by hot-water and sulphuric-acid treatments, and especially by the latter, but the best results were obtained by scratching the seed coat by the following method:—the seed was mixed with four to eight times its amount of window glass splinters of 1–3 cm. size, and the mixture rotated for 15–30 minutes at about 50 r.p.m. in a drum of cylindrical shape. A small motor was found convenient for this purpose.

23.23.19. WACH, A. Vergleichende Untersuchungen mit verschiedenen Färbeverfahren als Ersatz oder Ergänzung der Keimprüfung bei forstlichen Sämereien. **[Comparative investigations on different staining methods as alternative or supplementary means of testing the viability of forest seed.]** *Thar. forstl. Jb.* 93, 1942 (143–93). [G.g.] [Institut für Forstsamenkunde und Pflanzenzüchtung der Forstlichen Forschungsanstalt München.]

In the tests described, Eidmann's selenium method [cf. *For. Abs.* 1 (35–6, 120)] proved either superior or equal to Neljubow's indigo-carmine method [cf. *For. Abs.* 1 (87–8)] and Kusnezowa's iodine/potassium iodide method in determining the germination capacity of seed of Austrian Pine, Spruce, Weymouth Pine, and Beech (Kusnezowa's method is unsuitable for seed of the last-named species). Suggestions are made for a simplified grouping of seed by viability classes using the selenium and the indigo-carmine methods.

23.23.19 : 12.25. GÖKSIN, A. Altersermittlung beim Saatgut der Fichte und Kiefer. **[Age determinations on seed of Spruce and Pine.]** *Forstwiss. Cbl.* 64, 1942 (111–7). [G.g.]

Pine and Spruce seed stored for several years germinates more slowly than fresh seed. Thus even where there is no difference in the final germination capacity, the germination percentage after only a few days in the germinator is greater in fresh than in old seed. At a constant germinator temperature of 25° C., the germination percentage may be conveniently determined on the seventh day for Spruce and on the fourth day for Pine. Also, the rate of water absorption of old seed is slower than that of fresh seed, hence a further indication of the age of the seed may be obtained by weighing it at different stages in the germinator. Finally, some—not very reliable—indication is provided by the acid number, which tends to increase with the age of the seed, though it also appears to vary with parental characters and with conditions of seed treatment.

23.23.3. *Methods of Sowing*

23.23.3 : 12.25 : 45.12 : 13.2. KRAUCH, H. **Successful seed spotting of Douglas-Fir is not possible unless rodents are completely controlled.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 98, 1942. pp. 2.

Experiments show that while the rodent population was effectively reduced by poisoning, using thallium-treated sunflower seed as bait, the successful establishment of Douglas Fir seedlings was obtained only where the seed spots had been screened. [Cf. *For. Abs.* 1 (257).]

23.23.3 : 23.22.1. WAPPES, L. Erfahrungen über Freisaaten. **[Experiences with broadcast sowing.]** *Dtsch. Forstw.* No. 77/78. [1941?] [G.] *Abstr.* in *Forstarchiv* 18, 1942 (107).

An addendum to the paper noted in *For. Abs.* 3 (44). Sowing without soil cultivation can be the means of securing rapid regeneration at low cost. Fencing against game is not necessary until the second or third year. Sowing of Silver Fir is unsatisfactory under Beech, better under Scots Pine, and best under White Pine (*P. strobus*). Broadcast sowing of White Pine has been successful under fairly heavy shade, using seed at the rate of 1 kg. per ha., preferably with an admixture of Silver Fir seed. In general, nothing can be expected of either sowing or natural seeding of conifers if the humus bears a heavy growth of grass.

23.24. Formation of Stands by Planting

23.24 (410). MARRIOTT, C. **Replanting under war conditions.** *Quart. J. For.* 36, 1942 (49–53).

It is suggested that use be made of the labour of prisoners of war in the replanting of British woodlands, and that plans be formulated for the absorption in reforestation work of some of the surplus labour expected to become available following demobilization at the conclusion of the war.

23.24 : 12.25 : 23.21 (410). MAKINS, F. K. **Replanting softwoods.** *Quart. J. For.* 36, 1942 (70–5).

Soil-expectation-value calculations show that, under British conditions, Douglas Fir, Sitka Spruce, and European Larch may be expected to yield higher mean annual forest per cents. (i.e. the rates of compound interest which capital invested in forestry will earn) than other conifers.

23.24.1. *Planting Material*

23.24.1 : 23.26.3 : 12.25. CUMMINGS, W. H. **Exposure of roots of Shortleaf Pine stock.** *J. For.* 40, 1942 (490–2). [Tennessee Valley Authority, Norris, Tenn.]

Tests were made on the effect of exposing the roots of 1-year seedlings of Shortleaf Pine entirely to the atmosphere for periods of from 5 to 135 minutes. With increased exposure there was a marked trend of reduction in the proportion of trees thrifty two months after planting, in fall survival, and in first-season height increment.

23.24.3. *Spacing*

23.24.3 : 12.25 : 22.82 : 57.0. VANSELOW, K. Einfluss des Pflanzverbandes auf die Entwicklung reiner Fichtenbestände. **[Influence of spacing on the development of pure Norway Spruce plantations.]** *Forstwiss. Cbl.* 64, 1942 (23–37; 49–59). [G.g.]

An account of observations on 35-year-old unthinned stands on first-quality sites at Wessling in Bavaria which had been established using spacings of between 1 and 4 m. square. Spacings narrower than 1·3–1·4 m. square gave a mortality of approximately 30 per cent. or over, and are considered unsuitable under the prevailing conditions. The average height of the stands

did not appear to be influenced by spacing, but the mean diameter was greater in the wider spaced plantations. The stem form deteriorated and branchiness increased where the spacing exceeded 1·5–1·6 m. square, and this is recommended as the upper spacing limit for sites similar to those investigated. Stands spaced 1·3–1·5 m. square showed a larger mean annual timber increment than more widely spaced stands, but their establishment was more costly.

23.26. Plant Rearing. Nursery Practice

23.26 : 07.7. ALLEN, R. C. **Utility tractor for cultivating, fertilizing, and spraying forest tree seedlings.** *J. For.* 40, 1942 (432). [Mississippi Forest & Park Service.]

An International Harvester Company Farmall 'A' tractor was adapted to make a compact one-man unit with which it is possible to side-dress seedlings and cultivate fertilizer into the soil in one operation, to do 60 per cent. of the nursery weeding, and, with a trailer-type pressure spray, 150-gal. capacity, and boom attachment, to spray 3 rows of seedlings at a time. The unit is less tiring than the trailer-type cultivator and causes less mechanical injury to the seedlings. Per 8-hr. day the tractor uses about 4 gal. of petrol, cultivates and fertilizes an average of eighty 4 × 500-ft. seedbeds, and has been used to spray a total of 6 million seedlings and transplants.

23.26.3 : 12.26–8 : 24.51 : 23.27. PRIDHAM, A. M. S. **Growth of Pin Oak following transplanting and pruning.** *Proc. Amer. Soc. hort. Sci.* 39, 1941 (440). [Cornell University, Ithaca, N.Y.] E.M.B.

Transplanting caused a serious reduction in diameter growth during the subsequent two years, extending in most cases to the third year also. Neither root nor top pruning gave statistically significant differences in growth; hence other factors such as season, soil, and care in handling are probably important in connexion with the effects of transplanting.

23.26.4 : 11.47.12. FISCHER, H. Wachstumsförderung durch Sojaextrakt bei Baumschulaussaaten. **[Promotion of growth by soya bean extract in tree-nursery sowings.]** *Blumen u. Pflb.* 44, 1940 (122–3, 158–9). [G.]; *Forschungsdienst* 11, 1942 (64). Hort. Abs. 12 (348).

In trials at Pinneberg with deciduous and coniferous forest seed, both indoors and out, treatment of the seedbed soil with soya extract resulted not only in better germination but also in much better growth of seedlings. The result is attributed to increased microbiological activity of the soil. Soil analysis showed a great increase in azotobacter content as compared with untreated soil. Watering the seed with the extract just before sowing had no effect.

23.27. Arboriculture

23.27 : 12.26–8 : 12.11.3. MILNE, M. A., and GERLING, J. **Two fastigiate varieties of Sugar Maple.** [***Acer saccharum* vars. *columnare* and *monumentale*.**] *Trees, Sta. Monica, Calif.* 5 (2), 1942 (8).

23.27 : 12.26–8 : 31.0. DAVIES, P. A. **The history, distribution, and value of *Ailanthus* in North America.** *Trans. Ky. Acad. Sci.* 9, 1940 (12–4). [University of Louisville, Kentucky.] L.S.

A brief note on the history of *A. altissima* in cultivation and on its naturalization in North America. The tree is well adapted to city planting; it will withstand smoke and dust, is almost free from diseases and pests, is drought-resistant and tolerates a wide variety of soils. Disadvantages are its rapid seeding, free suckering, contamination of cisterns and wells by root penetration, and the evil smell of the flowers. No large plantings have been made for commercial use. The wood is light, soft, weak, and open-grained, suitable for cabinet wood, wooden ware, charcoal, and pulpwood; its susceptibility to decay, however, makes it of little value for lumber, railway ties or fence posts.

23.27 : 23.21. BAXTER, S. N. **Trees under wires.** *Arbor. News, Nat. Shade Tree Conf.* 7 (4), 1942 (26–7). Pl. Sci. Lit. 15 (15), (2).

Lists of trees suitable for planting under power lines.

23.3. *Afforestation*

23.3 (43.9). MOLCSANY, G. v. Waldanlagen in der ungarischen Tiefebene und Aufforstung verödeter Berghänge. **[Establishment of forest in the Hungarian plain and the afforestation of devastated mountain slopes.]** *Intersylva* 1, 1941. [G.] *Abstr.* in *Forstarchiv* 18, 1942 (109–10). [G.]

A scheme of 1935 provided for the afforestation of 110,000 ha., of which 31,500 ha. were shifting sand, 11,500 ha. sandy soils poor in nutrients, 21,000 ha. szik (alkali) soils, 12,000 ha. floodland and waterlogged areas, 10,000 ha. land suited to agriculture, and 24,000 ha. land to be planted with groups and rows of trees. Afforestation was to be carried out in some cases in combination with agricultural utilization. The proportions of the individual species to be used were Black Locust 45 per cent., Poplar 16 per cent., Oak 17 per cent., conifers 11 per cent., and remaining species 11 per cent., preference thus being given to fast-growing species. The plants are raised in State nurseries and delivered free. The State also takes over the technical preparations for afforestation and in some cases even the costs of soil preparation. In other cases the costs of soil cultivation and planting are borne by the owners. Owing to the difficult soil conditions, intensive cultivation is often required, and choice of site —made according to the ground flora—is of especial importance.

Besides the afforestation of the plains region, importance is also attached to that of waterlogged sites and partly devastated mountain slopes. In Hungary, as limited by the peace of Trianon, these areas amounted to about 32,000 ha., of which some 14,000 ha. have been afforested.

23.3. (45). AGOSTINI, A. Die Wiederaufforstung in Italien. **[Reforestation in Italy.]** *Intersylva* 1, 1940 (41–51). [G.] *Abstr.* in *Forstarchiv* 18, 1942 (109). [G.]

About 173,300 ha. have been afforested since 1867. During the 17 years of the Fascist régime the area afforested has amounted to 2½ times that of the previous period, and nine-tenths of the Fascist afforestation has been carried out by the Forest Militia.

23.3. (74.7) : 96.5. HOPKINS, A. S. **New York State's reforestation program.** *Bull. N. Y. St. Conserv. Dep.* No. 20, 1942. pp. 36.

The bulletin summarizes the history and progress of public and private plantation work in New York State since 1889, and touches on the various State policies which have been developed in this connexion. Emphasis is placed upon the importance of the afforestation of abandoned agricultural land, as well as the value

of such activities in providing work in times of depression. By the end of September, 1941, over 340,000 acres of sub-marginal farm lands had been afforested by public agencies.

23.3 (74.8) : 22.89. HETZEL, J. E. **Forest plantations in northwestern Pennsylvania.** *Occ. Pap. Allegh. For. Exp. Sta.* No. 3, 1941. pp. 5 + gphs., tbl., & plates.

An examination was made of 73 picked plantations on old pastures and cleared sites in the northern Allegheny Plateau of Pennsylvania. Nearly all the plantations were 20 years or more in total age and had shown a good initial survival. From the data obtained a relative performance index, based on quality and growth rate of individual stems, was computed for each of the principal species planted (Red, Scotch, Jack, White and Pitch Pines, Norway Spruce, and European and Japanese Larch). In general, Red Pine showed the best survival, form and diameter growth, although surpassed in average annual height growth by Jack Pine and European and Japanese Larch. It is concluded that for the sites studied, conifers as a class produce better forest plantations than do hardwoods. Planting in small pure blocks appeared to give better results than planting in alternate rows or other stemwise mixtures.

23.3 (77.5) : 12.19 : 23.2 : 11 : 47. STOECKELER, J. H., and LIMSTROM, G. A. **Ecological factors influencing reforestation in northern Wisconsin.** *Ecol. Monogr.* 12, 1942 (191–212). [Lake States Forest Exp. Sta.]

Availability of soil moisture during the first growing season was found to be the most important single factor in the success of forest planting and direct seeding. The most important causes of loss in recently established plantations were drought and May beetle larvae (*Phyllophaga* spp.).

A shallow water table had a marked beneficial effect on first-year survival of planted trees in drought years, and areas with a permanent water table within 5 ft. of the surface and not subject to excessive fluctuation were found to be excellent sites for direct seeding of Jack Pine. The presence of abundant surface-soil moisture had a marked moderating influence on summer soil-surface temperatures. Survival of 2-1 Red Pine in a year of severe drought varied from 16 per cent. in the open to 69 per cent. under a light canopy of Aspen, the difference being attributed to the effect of the cover in reducing evaporation.

23.3 (77.5) : 61.4 : 23.21 : 23.24.1. STOECKELER, J. H., and LJMSTROM, G. A. **A site classification for reforestation on the national forests of Wisconsin.** *J. For.* 40, 1942 (308–15). [Lake States Forest Exp. Sta.]

The classification described for planting sites in northern Wisconsin is based on four major factors: soil texture, presence or absence of an overstorey, depth of water table, and density of ground cover. Variations in these factors are discussed particularly as they influence choice of species, age class, planting method, and pre- and post-planting treatment of the site. Species and age class are recommended for each of 80 combinations of conditions and are listed in tabular form.

23.4. *Formation of Forest by Natural Succession*

23.4 : 12.19.4 (78.8). IVES, R. L. **Forest replacement rates in the Colorado Headwaters area.** *Bull. Torrey bot. Cl.* 68, 1941 (407–8). O.B.D.

Field studies and photographic records of this area, mostly in Grand County, Colorado, at elevations between 8,000 and 11,000 feet, have furnished evidence on the rate of replacement of evergreen forest that was burned off during Indian troubles in 1862–3. Reversion to evergreen forest has taken place through phases of grass and brush and Aspen. In terms of years since forest destruction, maximum brush growth has occurred at 25 years, maximum Aspen growth at 40 years, and substantial elimination of Aspen at 65 years. It is estimated that over 300 years will be necessary for the complete elimination of the scars. Where water supply is abnormal, or where exposure is great or the soil unstable, replacement rates will be slower than those indicated above.

23.6. *Care of Regeneration in the Initial Stage of Establishment*

23.6 : 12.25 : 23.13 : 23.22 : 44.1. PESSIN, L. J. **Stimulating the early growth of Longleaf Pine seedlings.** *Sth. For. Notes* No. 44, 1942 (2).

The removal of grass from around the seedlings greatly stimulated their height growth while all other treatments tested failed to have any significant effect.

24. TENDING OF STANDS AND TREES

24.2. *Thinnings*

24.2 : 12.25 : 57.0. EIDE, E., and LANGSAETER. **Yield investigations in Norway Spruce forest.** *Medd. norske Skogforsøksv.* 7 (2), [No. 26] 1941. pp. 143. [Nor.g.] *Abstr.* in *Allg. Forst- u. Jagdztg.* 118, 1942 (131–2). [G.]

Growth studies in Norway on even-aged Spruce stands of different quality classes that had been subjected to low thinnings of different intensity showed that total volume production and increment were hardly influenced by the intensity of thinning.

24.25 : 57.0 : 22.89. ADAMS, W. R., and CHAPMAN, G. L. **Crop tree measurements in thinning experiments.** *J. For.* 40, 1942 (493–8). [Vermont Agricultural Exp. Sta.]

In analysing growth measurements from 27-year-old White Pine thinning plots, it was found that those trees selected as potential crop trees did not show a decided increase in the percentage basal area increment per acre comparable to that found for all trees in the plots, the basal area increment per cent. for the crop trees being similar in the thinned and control plots. This difference in result depending on method of analysis was found also for measurements of diameter, height, live crown width, and live crown depth of 28-year-old Jack and Red Pines growing in pure plantations of different densities of stocking.

24.25 : 57.0 : 22.89. FROTHINGHAM, E. H. **Twenty years' results of plantation thinning at Biltmore, N.C.** *J. For.* 40, 1942 (444–52). [Appalachian Forest Exp. Sta.]

An account of thinning experiments in small plantations of pure White Pine, mixed White and Shortleaf Pine and mixed White Pine and Sugar Maple, which are 40–45 years old and have been thinned four times. In general, the effect of the thinning has been to increase the mean annual growth and quality of the residual stands in comparison with that of the controls, and in the case of White Pine to increase the crown ratio of individual trees, with an accompanying increase in the rate of basal-area growth.

24.3. *Opening of the Canopy. Release and Improvement Fellings*

24.31. BICKERSTAFF, A. **Interim results from girdling.** *Silvic. Leafl. Dom. For. Serv.* No. 11, 1942. pp. 2. [Petawawa Forest Exp. Sta.]

Some 800 trees per acre in a 50-year-old White Pine stand containing a small admixture of other species, were girdled to release 400 selected trees. The girdling tool was a 1-in. chain mortice girdling saw. Girdled trees that were dead 5 years after the operation included all Red Pine, White Spruce, Balsam Fir, White Birch, 90 per cent. of White Pine under 6 in. d.b.h. and 47 per cent. over that size, and 82 and 62 per cent., respectively, of Poplar for similar size classes. Ninety-two per cent. of the girdled trees were still standing at that time. Species most susceptible to wind breakage were Poplar, Red Pine, and Balsam Fir in the order named.

24.31. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

An experiment to determine the effect of girdling standing trees of different species indicates that response to girdling varies with species, and that time of girdling has an important effect on the subsequent life of the tree, this also varying with species (p. 69).

24.31 : 12.26–8. PESSIN, L. J. **Recommendations for killing scrub Oaks in the Longleaf Pine type.** *Sth. For. Notes* No. 39, 1941 (2).

Either by pouring sodium arsenite solution (white arsenic 40 lb., caustic soda 10 lb., water 15 qt.) into holes 1–2 in. deep and ½-in. in diameter in the roots just below the root collar or by removing a band of bark and cambium from just below the ground surface to about 16 in. up the bole.

24.4. *Shelterbelts. Windbreaks*

24.4 (73) : 96. HARING, C. T. **The 'Shelterbelt'—eight years of progress.** *Univ. Wash. For. Cl. Quart.* 15 (3), 1941–42 (10–4). [Prairie States Forestry Project.]

Note on the purposes of shelterbelts and on factors that determine their composition with reference to the Prairie States Forestry Project.

24.5. *Pruning*

24.51 : 12.25. MATTOON, W. R. **Pruning Southern Pines.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1892, 1942. pp. 34. [U.S. Forest Service.]

This bulletin gives general information on the value of pruning, on pruning tools and their use, methods of pruning, selection of trees, cost of pruning and returns, etc.

24.51 : 12.25 : 22.88.2. BRITISH COLUMBIA. **Report of the Forest Branch for the year ended December 31st, 1941.** Govt. Printer, Victoria, B.C. 1942. pp. 55.

In second-growth Douglas Fir stands pruning is the silvicultural treatment that has the best chance of giving satisfactory returns under present economic conditions. Pruning operations should be started early in such stands (10–15 years of age); much more rapid occlusion follows the pruning of living branches than of dead branches (p. G14).

3. FOREST UTILIZATION. FOREST TECHNOLOGY

31. PROPERTIES AND ANATOMY OF WOOD

31.0. *General Information on Woods*

31.0. **Partial list of uses of forest products in substitutions for steel and tin.** U.S. Forest Products Laboratory, Madison, Wis. No. *R*1289, 1942. pp. 7. P.R.

31.0 : 12.25 : 12.26–8. **Identification of woods.** *Timber of Canada* 2 (2, 3, 4, 5, 6, 7, 8), 1941–42 (39–40, 31–2, 39–40, 31–2, 39–40, 47–8, 23–4 + plates).

Tree and timber characters, uses and range of various species in Canada, with coloured plates showing appearance of the wood. Species dealt with are *Betula lutea*, *Picea glauca*, *Pinus banksiana*, *Acer saccharum*, *Tsuga canadensis*, *Tilia glabra*, and *Pinus resinosa*.

31.0 : 12.25 : 12.26–8. BETTS, H. S. **American woods.** U.S. Forest Service, Washington, D.C. 1941.

Four pamphlets which are part of a series, each giving briefly the description, nomenclature, distribution and growth, supply, production, properties, and principal uses of one of the commercial forest trees of the United States. These pamphlets deal with Eastern White Pine (*Pinus strobus*), Noble Fir (*Abies nobilis*), Engelmann Spruce (*Picea engelmanni*), and Black Cherry (*Prunus serotina*). [Cf. *For. Abs.* 1 (270); 2 (44 : 217); 3 (132 : 307).]

31.0 : 12.26–8. Linde. [Lime.] *Holz* 4, 1941 (335–6). [G.] P.R.

Summary of properties and uses of *Tilia parvifolia* [*T. cordata*] and *T. grandifolia* [*T. platyphyllos*], prepared at Eberswalde.

31.0 : 12.26–8. **Okumé.** *Holz* 4, 1941 (303–4). [G.] P.R.

Summary of the properties and uses of *Aucoumea klaineana* Pierre, prepared at Eberswalde.

31.0 : 12.26–8 : 21. MAYER-WEGELIN, H., and BERKEL, A. Das Holz der orientalischen Buche *Fagus orientalis* Lipsky. [**The wood of Oriental Beech, *Fagus orientalis* Lipsky.**] *Mitt. Forstwirt.* 11, 1940 (211–43). [G.] *Abstr.* in *Holz* 4, 1941 (330–1). [G.] P.R.

The distribution, characteristics, and habitats of *Fagus orientalis*, which is superior in growth to *F. sylvatica*, are described in detail. The species is a native of Asia Minor and the Caucasus, but overlaps with *F. sylvatica* in certain parts of the Balkans, where it is connected with the latter by many intermediate forms. *F. orientalis* stagnates in the warmer localities, but tolerates a fair degree of cold and, to some extent, summer drought. In Turkey it is the only species of Beech, occupying about 10 per cent. of the forest area and occurring in extensive pure and mixed stands on the northern side of the northerly mountain ranges. Exploitation has been difficult in the past and much of the Beech is overmature. The wood is used for mining timber, sleepers, vehicles, cooperage, furniture, oars, packing cases, and many small articles such as sieve rims, shoe lasts and brush backs; as yet it has been little used for plywood, though quite suitable for this purpose. Red heartwood is formed from 80–100 years onwards, the coloured wood being at first uniformly light red-brown and circular in outline, later forming alternate concentric zones of light and dark wood and becoming

irregularly wavy in outline at the transition to sapwood. In the darker zones there are numerous tyloses in the vessels and brown deposits in the ray cells. Red heartwood is present in all older trees and its diameter increases regularly with age, the coloured portion beginning at the butt, reaching up to about two-thirds of the stem height, and having a spindle-shaped outline in longitudinal section. Its moisture content in a 135-year-old tree was found to be 51 per cent., in contrast to 84 per cent. in the sapwood. From this it is concluded that, unlike *F. sylvatica*, *F. orientalis* possesses a true coloured heartwood. In wood tests the sapwood and red heart had the same bending strength and modulus of elasticity (977 kg./cm.^{2} and 131,600 kg./cm.^{2}, respectively, at 12 per cent. moisture). The specific gravity is (0·522–) 0·633 (–0·664) g./cm.^{3}. Shrinkage values are—longitudinal 0·5 per cent., radial 5·0 per cent., tangential 10·5 per cent., and volumetric 15·4 per cent. The lighter, but not the darker, portions of the red heartwood will absorb creosote.

31.0 : 12.26–8 : 21 : 56–7. KOLLMANN, F. Die Esche und ihr Holz. [**The Ash and its wood.**] Schriftenreihe Eigenschaften und Verwertung der deutschen Nutzhölzer. Julius Springer, Berlin. 1, 1941. pp. 147. [G.] [Mechanisch-technologisches Instituts der Reichsanstalt für Holzforschung, Eberswalde.] P.R.

This book has the unusual merit of being a complete monograph in the sense that it covers both silviculture and utilization. Such features as distribution, ecological associations, natural and artificial regeneration are dealt with rather briefly but a full account is given of the results of research on growth in height and diameter, ring-formation in stems, branches and roots, and such subjects as stem form. The greater part of the work, however, is concerned with the uses and properties of Ash timber and the anatomical, chemical and other factors that appear to be related to the relatively wide variations in the properties of this timber. Ash timber is always important, but particularly so in wartime, and, owing to its special uses, comparatively small variations in strength are of real practical importance. Consequently a considerable amount of scattered research has been done in this field and it is very useful to have the results grouped together in a single volume. The list of physical and mechanical properties discussed is comprehensive and there are also sections on the chemistry of the wood and the fine structure of the cell wall and on protection, the latter including insect and fungus pests of the living tree and of the timber, means of preserving the timber and a discussion of seasoning characteristics. The concluding chapter gives an account of the uses of Ash for special purposes such as automobile bodies, railway coaches, skis and tennis racquets, with details of the methods of manufacture and of steaming and bending the wood for such purposes. The book is well illustrated with photographs and diagrams, is concisely written and appears to cover all the relevant published research. L. C.

31.0 : 12.26–8 (71). **Canadian hardwoods.** *Timber of Canada* 2 (6), 1941–42 (33–6).

Notes on the uses of *Betula lutea* and *Acer saccharum* timber.

31.0 : 12.26–8 : 98 (73). SLIFKO, C. W. **South American Balsa wood in national defense.** *Industr. Ref. Serv. U.S. Dep. Comm.* Pt. 4—*For. Prod.* No. 26, 1941. pp. 3.

Note on Balsa wood and its uses, and U.S. import statistics for recent years. [Cf. *For. Abs.* 3 (273–7).]

31.0 (66.4). **Sierra Leone native timbers.** *Forest Department Information Notes.* Govt. Printer, Freetown, Sierra Leone. 1942. pp. 8.

A list of recommended native timbers classified as (*a*) durable termite-resistant woods, (*b*) for high-class furniture or decorative work, and (*c*) utility woods suitable for interior work and not necessarily durable without preservative treatment. Information includes botanical and trade names, vernacular names, habitat and main distinguishing features of the tree, and general appearance, properties and uses of the timber. This is not intended as a complete list.

31.0 (82) : 31.1 : 31.2. TORTORELLI, L. A. Maderas Argentinas. [**Argentine woods.**] *Biblioteca Agronomica y Veterinaria* Vol 3, 1940. pp. 218 + maps + plates. [Span.] Facultad de Agronomia y Veterinaria, Universidad de Buenos Aires.

About fifty of the most important timber-producing species of Argentina are described in detail; with the exception of *Araucaria angustifolia* and *A. araucana* these are all hardwoods, though two other softwoods, *Fitzroya cupressoides* and *Libocedrus chilensis*, figure in the lists of characters without being described in detail. The hardwood genera described are *Alnus*, *Apuleia*, *Aspidosperma*, *Astronium*, *Bulnesia*, *Cabralea*, *Caesalpinia*, *Calycophyllum*, *Cedrela*, *Enterolobium*, *Erythrina*, *Gourliea*, *Jacaranda*, *Juglans*, *Lomatia*, *Luehea*, *Nothofagus*, *Patagonula*, *Prosopis*, *Pterogyne*, *Salix*, *Schinopsis*, *Tecoma*, *Tipuana* and *Torresea*.

The most important sections of the work, constituting three-quarters of the printed matter, are the key to the timbers and the specific descriptions. Both key and descriptions include macroscopic and microscopic wood characters and each description includes also a short description of the habit, distribution and taxonomic characters of the tree and the physical and mechanical properties and uses of the timber. These descriptions appear to be seldom based on more than two specimens of the wood per species.

The remaining quarter of the book consists largely of explanations and definitions of the features and terms used in the descriptions, together with lists of the timbers classified according to such features as weight, texture, grain, colour and anatomical features. Five maps show the distribution of the main types of vegetation and of the individual species, and photomicrographs (× 100) of the transverse and tangential sections are provided for each timber.

31.0 (85). WOYTKOWSKI, F. L. Maderas del Oriente peruano. [**Woods of eastern Peru.**] *Bol. Mus. Hist. nat. 'Javier Prado', Lima* 4, 1940 (471–8). [Span.] N.H.M.

Notes on specimens from a herbarium collection at Lima, recently identified by Standley and Record. The material included specimens of *Tabebuia*, which furnishes valuable timber for cabinet making.

31.1. *Structure. Anatomy. Identification*

31.1. KISSER, J. Mikroskopische Veränderungen der Holzstruktur durch mechanische Beanspruchung, insbesondere bei der Schnittanfertigung. [**Microscopic changes in wood structure due to mechanical stressing, particularly in the preparation of sections.**] *Bot. Archiv* 42, 1941 (100–48). [G.] R.M.I.

Changes caused by various methods of preparing woody materials for microscopic examination are discussed. Boiling water or steam causes more marked swelling of the secondary wall layers of woody cells than does water at room temperature. The swelling is reversible except in layers containing hemicelluloses. The secondary wall layers in air-dry condition possess very slight radial elastic extensibility; this increases with increasing swelling. Plastic changes in the secondary walls occur neither after treatment with cold water nor with boiling water or steam. Treatment with boiling water or steam does not appear to produce any changes in the middle lamella that lead to displacement of the cells from each other. Experiments with Frey-Wyssling's 'lignostone' process showed that the middle lamella is unaffected by this treatment and seems to be particularly resistant to deformation, though the secondary wall layers undergo partly reversible and partly irreversible deformations. The tearing and distortion of the cells by various causes is discussed.

31.1. MILANEZ, F. R. **Crystalliferous strands.** *Chron. bot.* 7, 1942 (68–9). [Serviço Florestal, Jardim Botánico, Rio de Janeiro.] O.B.D.

Cf. *For. Abs.* 1 (272). The author considers it advisable to modify the official definition of wood parenchyma as follows:—'Wood parenchyma or xylem parenchyma: Vertical parenchyma composed of single cells (fusiform wood parenchyma cells) and (or) cell series (wood parenchyma strands) each of which *usually* corresponds in height to its cambial initial'.

31.1. STERLING, C. **The use of chloroform in clearing wood sections.** *J. For.* 40, 1942 (428–9). [University o California.]

Disadvantages in the use of either xylol or clove oil/cedar oil are noted. Chloroform causes less brittleness and curling than xylol and has other advantages. It is miscible with 95-per-cent. and 100-per-cent. ethyl alcohol, xylol, Canada balsam, acetone, and ether/alcohol. Disadvantages are its volatility and slightly higher cost. A suggested schedule of clearing includes: (1) usual dehydration series, after staining, to 95-per-cent. ethyl alcohol, 5 min.; (2) chloroform and 100-per-cent. ethyl alcohol, 1 : 1, 5 min.; (3) chloroform, 5 min.; (4) mount in balsam.

31.1 : 12.14.1. BAILEY, I. W., and BERKLEY, E. E. **The significance of X-rays in studying the orientation of cellulose in the secondary wall of tracheids.** *Amer. J. Bot.* 29, 1942 (231–41). [Biological Laboratories, Harvard University, Cambridge, Mass.] O.B.D.

31.1 : 12.14.1. PRESTON, R. D. **Dispersion of cellulose strands in cell walls.** *Nature, Lond.* 149, 3786, 1942 (580–1). [Department of Botany, University of Leeds.]

In reply to Frey-Wyssling's letter to *Nature* 149, 1942 (384) [cf. *For. Abs.* 4 (31)] the author points out that he does not at all question the existence of dispersion and of changes of dispersion, but simplifies preliminary calculations by taking the extinction direction of a wall of the 'dispersed' type as a hypothetical unique 'cellulose chain direction'. He further affirms that there is no fundamental difference between his own and Frey-Wyssling's attitude concerning the 'dispersed' texture, though he hesitates to accept Frey-Wyssling's 'reticulate' texture as it stands.

31.1 : 12.25. BANNAN, M. W. **Wood structure of the native Ontario species of *Juniperus*.** *Amer. J. Bot.* 29, 1942 (245–52). [Department of Botany, University of Toronto.] O.B.D.

Many of the trends in anatomical variation in different parts of the tree in *J. virginiana* resembled those observed in *Thuja occidentalis* [cf. *For. Abs.* 4 (31)]. Similar tendencies were noted in such characters as size of the tracheids, size and distribution of the intertracheary pits, size and number of pits per crossing field, height and distribution of rays, and size of ray cells. Other features usually regarded as valuable for purposes of identification such as the thickness and character of the walls of the ray and xylem parenchyma cells also varied considerably. Because of such variability it is clear that the selection of characters which will ultimately prove diagnostic must be held in abeyance until there is more complete knowledge of the range of variation in related forms.

An expansion of certain of the rays to a multiseriate condition, such as observed in *Thuja occidentalis*, was also noted in all three local species of *Juniperus*. All adventitious roots arising from stems or branches connected with rays in the xylem, were nearly always of this unusual type. *Author's summary.*

31.1 : 12.26–8. RECORD, S. J. **American woods of the family Theaceae.** *Trop. Woods* No. 70, 1942 (23–33).

Descriptions of the woods of the American genera with brief notes on uses, common names, and distribution. A key to the woods is appended.

31.1 : 33.36.3. HOWARD, A. L. **Studies of the identification of timbers. With a note on the seasoning of wood.** Macmillan & Co., Ltd., St. Martin's Street, London. 1942. pp. 110.

The 'studies' referred to in the title are 504 photomicrographs of timbers—cross section × 10, taken by transmitted light. The author apparently disapproves of written descriptions and regards the standard works on wood structure and identification as taking too long to read to be generally useful; thus, the general purpose of the publication seems to be to provide short cuts to identification, and to establish a ready means of proving the identity of any particular timber, particularly in law suits, on the analogy of the human fingerprint. Each photograph illustrates about one and a half centimetres of the surface of a single specimen and it is not difficult to imagine the layman, with no knowledge of wood structure, being more impressed with the obvious but insignificant differences that normally occur between two photographs of different specimens, even from the same tree, than with the significant point of similarity. Without any text, too, there is no means of telling how many other woods there may be that have a similar type of structure.

The author airs a grievance in the preface on the subject of names. It is a little surprising to find 'the professor of botany' held to blame as 'responsible for names given to wood from the colour or appearance of the bark or leaf, etc., for example, Blue Gum.' The author himself does not lessen the 'added handicap of nomenclature'; for example, he objects to the name She Oak, yet includes African Oak (*Oldfieldia africana*) as one of the three Oaks illustrated, the others being Brown Oak and Japanese Oak. Scientific names are appended to most of the common names but there are

many inexplicable omissions; for example, of the seventeen 'Mahoganies' illustrated only three are given even a generic name and one of the two specific names given is misspelt. Quite a number of the photographs are poor in quality and some are too obscure to be of any practical value.

After the photographs comes a 'Note on the seasoning of wood'. Half of this consists of a general account of the principles of drying together with a number of digressions on such subjects as whether wood can ever be said to be 'naturally' seasoned, and some statements that will surprise those who have made a scientific study of seasoning. Various types of kilns and their recording instruments are described and methods of stacking and clearing are briefly discussed.

L. CHALK.

31.2. *Physical Properties*

31.22. Relation to Water, Air, Gases

31.22.1 : 31.21.4. NARAYANAMURTI, D. **The variation of the electrical resistance of Indian timbers with moisture content.** *Indian For. Bull. (n.s.) Utilisation* No. 105, 1941. pp. 7 + plates. [Forest Research Institute, Dehra Dun.]

From tests on several timbers using a needle-type electrical moisture meter, it appears that, with suitable grouping of Indian timbers according to their resistance, the method is likely to prove useful as a rapid means of determining moisture in wood.

31.23. Weight. Specific Gravity

31.23 (82). Tabla de peso por metro cúbico de las principales maderas argentinas secadas al aire en Buenos Aires. **[Table of weights per cubic metre of the chief Argentine timber species air-dried at Buenos Aires.]** *Mundo Maderero* 3 (26), 1942 (11). [Span.]

31.27. Mechanical Strength

31.27 : 12.25 : 31.1. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

Further investigations with Indian Spruce (*Picea morinda*) [cf. *For. Abs.* 3 (220–1)] indicate that the timber is liable to be weak when the late wood is extremely narrow and shows up as a thin narrow darkish line and when transition from early to late wood is abrupt. It was found to be stronger than North American Sitka Spruce in bending and compressive strengths but slightly weaker in impact strength (pp. 44, 49).

31.27 : 12.26–8. THUNELL, B. Jämförande undersökning över vissa hållfasthetsegenskaper hos ask-, björk- och bokvirke. **[Comparative investigation of certain strength properties of Ash, Birch, and Beech timber.]** *Tekn. Tidskr.* 72 (Sec.E), 1942 (65–9). [Sw.sw.] P.O.

Bending and impact tests on steamed and unsteamed samples of Ash, Birch and Beech at temperatures of 22°, 0°, and – 20° C., showed that lowering the temperature to – 20° effected only slight decreases in strength values, though elastic and plastic changes of form diminished somewhat and the materials therefore reacted more stiffly. The modulus of elasticity was about 20 per cent. higher in Birch than in the other two species. Both Birch and Beech had higher strength values than Ash and might well compete with it as material for tools, sports goods, etc. Test results are tabulated in detail.

31.27 : 31.22.1 : 12.25. GABER, E. Der Einfluss der Holzfeuchtigkeit auf den Elastizitätsmodul von Nadelholz. **[The influence of moisture content on the modulus of elasticity of coniferous wood.]** *Holz* 4, 1941 (277–9). [G.] [Versuchsanstalt für Holz, Stein, Eisen. Techn. Hochschule Karlsruhe.] P.R.

From the tests described it is concluded that, although the modulus of elasticity of softwood timber decreases with increasing moisture content, the nail-holding quality of softwood boards remains unaffected for practical purposes.

31.27 : 33.12. HARRAR, E. S. **Some physical properties of modern cabinet woods—II. Screw-holding power.** *Trop. Woods* No. 70, 1942 (1–15). [School of Forestry, Duke University.]

Two tables are given to show the screw-holding power of 92 cabinet woods:—(*a*) test results with No. 6 and No. 10 screws, arranged by trade names of the species; (*b*) relative screw-holding power of the species, based on tests with No. 6 screws, in the groups of low, intermediate, and high screw retention, respectively. Ring-porous woods exhibited greater variation between side and end extractions than did diffuse-porous woods. Screws were more easily withdrawn from radial than from tangential faces. There appeared to be closer correlation between screw-holding power and hardness than between screw-holding power and specific gravity. Woods of high density showed no more variation in screw-holding power on different faces than that recorded for any single face.

An appendix gives hardness values of 4 further woods as a supplement to the paper noted in *For. Abs.* 3 (310).

31.27 : 33.4. SUENSON, E. Die Lage der Nullinie in gebogenen Holzbalken. **[The position of the line of zero stress during the bending of wooden beams.]** *Holz* 4, 1941 (305–14). [G.g.] P.R.

An account of tests on beams and boards of Spruce and Pine to investigate the course of deflection and especially the changes in the position of the line of zero stress, the influence of the moisture content, and the mechanism of breakage.

31.3. *Chemical Properties*

31.3 : 12.11.11. STAUDINGER, H. Über den micellaren, makromolekularen und übermolekularen Bau der Cellulose. **[On the micellar, macromolecular and hypermolecular structure of cellulose.]** *Cellulosechemie* 20, 1942 (1–14). [G.] [Forschungsabt. für makromolekulare Chemie des Chemischen Laboratoriums der Univ. Freiburg i. Br.] P.R.

A few original experimental results are given in this article, which is mainly, however, an account of past and present theories of the structure of cellulose and cellulosic fibres from the chemical viewpoint. There are eleven sections, as follows: 1. Older concepts of micellar structure. 2. Later cellulose formulae based on the work of Sponsler and Dore. 3. Arguments for the chain formula of cellulose. 4. The micellar concept according to Meyer and Mark. 5. The supposed skin-substance of cellulose fibres. 6. The macromolecular concept of cellulose structure. 7. Submicroscopic structure of cellulose. Orientation of macromolecules within natural and artificial fibres. 8. Differences

between natural and regenerated celluloses. 9. Differences in solubility between natural fibres and regenerated celluloses. 10. Topochemical reactions. 11. Highly concentrated cellulose solutions. Sections 1 to 5 are mainly of historical interest. [Cf. *For. Abs.* 4 (77–80).]

31.3 : 12.11.16 : 34.26. ARRHENIUS, O. Fettmängdens variationer hos våra träd. **[Variations in fat content in Swedish trees.]** *Svensk bot. Tidskr.* 36, 1942 (95–9). [Sw.] L.S.

Wood samples of the various species, all from a mixed stand about 15–20 years old, were taken throughout the course of a year, and the content of ether-extractible substances (in per cent. of dry matter) was used as a rough measure of the fat content. The species are arranged on the basis of the analyses into four groups:—(i) Oak and Maple, with very low ether-extractives (not above 0·22 per cent. for the former and 0·4 per cent. for the latter) throughout the year. (ii) Alder, Elm, Ash, and Mountain Ash, with ether-extractive contents of about 0·5 per cent. in summer and 1 per cent. in winter. (iii) Aspen, Birch, Spruce, and Goat Willow, with ether-extractive contents between 0·75 and 2 per cent., Aspen and Goat Willow differing from the rest in showing a sudden maximum in April. (iv) Lime and Pine, with winter ether-extractive contents of 6–7 per cent.

In contrast to all other species, Spruce and Pine had a marked minimum of ether-extractives in June/July. All species except Aspen and Goat Willow showed a decreased ether-extractive content in the spring months. Comparison with temperature conditions suggests that the variations in ether-extractive content are not directly connected with this factor but are probably determined by an inherent periodicity.

The high winter values for Pine may possibly be of practical interest. The sulphate-pulp mills consume a large part of the Pine cut—about 6 million stacked cu. m.—and at 6 per cent. fat content this amount might contain 120,000 metric tons of fat. Even if half of the ether-extractives were fat and the remainder resin it might be possible to devise some process for economic fat recovery. [Cf. *For. Abs.* 3 (136).]

31.3 : 12.25 : 33.32. IWADARE, K. **Lignin. I. Ethanolysis of Pine and *Cryptomeria* from Japan.** *J. chem. Soc. Japan* 61, 1940 (380–2). Chem. Abs. 36 (2407–8). P.R.

31.3 : 12.26–8 : 33.32. IWADARE, K. **Lignin. II. Lignin of *Paulownia imperialis*.** *J. chem. Soc. Japan* 62, 1941 (186–9); *Bull. chem. Soc. Japan* 16, 1941 (150–4). [E.] Chem. Abs. 36 (2408). P.R.

31.3 : 31.41. SCHMIDT-NIELSEN, S., and HÖYE, J. **Resistance of Pine lignin.** *Svensk kem. Tidskr.* 53, 1941 (287–90). [G.] Chem. Abs. 36 (896–7). P.R.

Chemical analyses on a piece of Pine post that had been submerged under sea water near Trondheim for over 800 years gave approximately the same results as for normal wood.

31.3 : 33.32. ERDTMAN, H. **Developments in lignin chemistry. I. Sidelights on recent work. II. The 'architecture' of lignin. III. Sulphur-lignin reactions.** *Chem. Age* 1942 (231–2, 243–4, 253–4). [Cellulose Industry Central Laboratory, Stockholm Technical College.] P.R.

31.4. *Durability. Decomposition*

31.4 : 33.36.1 (67.6). SANGSTER, R. G. **The durability of some Uganda timbers and poles in the ground.** *E. Afr. agric. J.* 7, 1941–42 (122–6, 208–11).

Report on 'graveyard' tests on the resistance to termite and rot of (1) untreated square heartwood specimens of different species obtainable in large sizes and normally sawn for use in more or less permanent work; (2) small round poles of different species, such as are used in the construction of huts and temporary buildings; and (3) untreated and treated poles of *Celtis zenkeri* and *C. soyauxii* of a size suitable for telegraph poles and fairly heavy temporary structures. The following preliminary conclusions were reached as a result of these tests:—

(1) Considering that the life of squared heartwood in the 'graveyard' is shorter than might be expected in actual use, it is possible to recommend for trial those species that have been consistently good throughout the period of the test (4 years). These are *Albizzia coriaria, Chlorophora excelsa, Cynometra alexandri, Erythrophleum guineense,* and *Mildbraediodendron excelsum.*

(2) In recommending small poles for use in contact with the soil it may be said that few, if any, of the species tested will give satisfactory results in conditions similar to those of the 'graveyard' for more than two years. It is known, however, that rot is a primary cause of most failures, sometimes the sole cause, and that it frequently paves the way for attack and demolition by termites. Taking into consideration the protection afforded against rot by shelter and shade when the poles are used in buildings, several species can be suggested for trial. These are *Albizzia zygia, Combretum binderanum, C. gueinzii, Dalbergia melanoxylon, Hexalobus monopetalus, Hymenocardia acida, Lasiodiscus mildbraedii, Markhamia platycalyx, Teclea nobilis, Terminalia brownei* and *Ziziphus mauritiana.*

(3) Untreated *Celtis zenkeri* can be recommended for buildings. When treated by boiling in creosote or mixed creosote and paraffin both *C. zenkeri* and *C. soyauxii* are worth trial in heavy structures.

31.42. Attack by Plant Organisms

31.42.11 : 33.2 : 12.25 : 12.21 : 33.36.1. FRITZ, C. W., and ATWELL, E. A. **Decay in red-stained Jack Pine ties under service conditions.** *Circ. Dom. For. Serv.* No. 58, 1941. pp. 19 + plates. [Forest Products Laboratories, Ottawa.]

Ties (sleepers) containing red stain (caused by *Fomes pini* and another fungus), which is known not to lower the bending or compression strength of the ties or reduce their spike-retention properties, were selected, half of them being treated with creosote, and both treated and untreated ties were placed in track. During ten years' service it was found that red-staining fungi did not cause decay in either creosoted or untreated ties and that the development of these fungi was arrested. At the end of this period untreated ties were in an advanced stage of decay caused by attack of secondary fungi, the dominant species being *Lenzites saepiaria.* While creosote treatment did not sterilize the ties, it gave them good protection and reduced the viability of both red-stain fungi.

31.43. Attack by Animal Organisms

31.43 : 13.2 : 12.25. DUMBLETON, L. J. ***Anobium magnum* (Coleoptera, Anobiidae): a new borer.** *N.Z. J.*

Sci. Tech. 22, 1941 (294B–299B). [D.S.I.R., Cawthron Institute, Nelson.] L.S.

Descriptions are given of the adult and larva of this species from wood of *Picea abies* and *Dacrydium cupressium* in New Zealand. *A. magnum* appears to be less common than *A. punctatum*, but where it does occur the damage may be very severe. In badly infested flooring of *D. cupressinum* that had been down for less than 6 years in a damp, ill ventilated situation, most of the larval burrows were in the bottom half of the boards, which was reduced to powder, leaving the bottom surface as a thin lamina. All the emergence holes, which were $\frac{3}{32}$–$\frac{1}{8}$ in. in diameter and circular or subcircular in outline, were through the bottom. The pupal cell, constructed just below the emergence hole, was dark brown and apparently made with some secretion of the larva. Streaks of dark 'heart' wood, probably due to fungal infection of the wood above and below a *Platypus* tunnel, were not attacked. It is believed that the life cycle of *A. magnum* may occupy two years.

31.43 : 13.2 : 13.15. HOLWAY, R. T. **Tube-building habits of the eastern subterranean termite.** *J. econ. Ent.* 34, 1941 (389–94). R.A.E. A30 (186).

Analysis of termite attacks on buildings and results from laboratory experiments agree with previous reports that subterranean termites of the genus *Reticulitermes* rarely, if ever, construct tubes upwards over foundation walls in the open. Cases in which such activity has been observed have resulted from excessively large colonies that developed where there was wood in the ground adjacent to the foundation walls. In dark, confined places, such as basementless areas, *Reticulitermes* may build tubes over foundation walls in order to reach wood above. The probability or frequency of this activity depends upon such factors as the relation of termite population to size of area, the presence of wood adjacent to the wall, and ventilation. The majority of tubes seen on foundation walls in the eastern United States are constructed downwards and not upwards. Under special conditions, termites may show unusual types of activity, such as travelling for many hours without tubes, constructing tubes from both ends, or building up many feet in the open.

31.43 : 13.2 (96.1–8). LEVER, R. J. A. W. **Entomological notes.** *Agric. J. Fiji* 12, 1941 (77–80). R.A.E. A30 (315).

An ambrosia beetle from Coconut trunks, previously identified as *Xyleborus perforans* Woll., now proves to be *X. testaceus* Wlk. It has been recorded from twigs of *Hydnocarpus* and trunks of *Citrus*, and more recently from logs of *Endospermum* sp. used in the construction of banana cases. To control this borer, timber should be stacked for as long as possible before use and well ventilated, as seasoning kills the developing larvae. The Platypid *Crossotarsus saundersii* Chapuis has been found in newly barked logs of *Cynometra grandiflora* and branches of a hardwood, probably *Sideroxylon* sp., and the Bostrychid *Xylothrips religiosus* Boisd. in posts of *Cynometra*.

31.8. *Quality and Defects of Timber*

31.8 : 12.25 : 12.11 : 31.1. WERSHING, H. F., and BAILEY, I. W. **Seedlings as experimental material in the study of 'redwood' in conifers.** *J. For.* 40, 1942 (411–4). [Harvard University, Cambridge, Mass.]

From the experiments described, using small seedlings of White Pine (*P. strobus*), it is concluded that the formation of 'redwood' or compression wood in conifers is correlated in some manner with the movement of auxin under the influence of gravity, but that the phenomenon is so complex that much additional investigation is needed.

31.8 : 12.25 : 31.1. BURGER, H. Der Drehwuchs bei den Holzarten. I. Drehwuchs bei Fichte und Tanne. **[Twisted growth in tree species. I. Twisted growth in Norway Spruce and Silver Fir.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 22, 1941 (142–63). [G.g.f.]

The following observations were made on round timber of various dimensions, ranging from beansticks to telegraph poles and heavy beams. The twist of the fibres was usually left-handed in young trees, at a later age the fibres straightened out, and in old trees the direction of the twist was predominantly right-handed. In timbers of medium or large diameter, the angle of the twist, if left-handed, was smaller in the butt portion than in the top portion; if the twist at the butt was right-handed the fibres generally straightened higher up and twisted left at the top, exceptions to this rule being more frequent in *Abies* than in *Picea*.

32. HARVESTING OF WOOD. LOGGING

32 : 76.1. **A graphic method of computing estimates of logging costs for the Douglas Fir region.** *W. Cst. Lumberm.* 69 (4), 1942 (36–9).

A study was made of a wide range of logging operations and of the varying combinations of factors contributing to their cost in order to develop a simple mechanical method, in the form of an alinement chart, for taking into proper account all significant cost factors when estimating logging costs. In order to reduce the number of variables to be considered at any one time the logging operation was divided into two parts—(1) log making, and (2) yarding—and separate evaluation charts have been developed for each of these. Analysis of data and construction of the charts are discussed, and the use of the charts is illustrated by three case studies.

32 : 8. WACKERMAN, A. E. **Organization of logging operations for efficiency.** *Sth. Lumberm.* 164 (2069), 1942 (49–50, 53).

Constantly varying conditions in logging make for frequent changes in organization, and efficiency requires that a working balance be maintained between each step of the operation. For the type of logging under consideration it is pointed out that the system of loading logs is the key to the actual production organization and that greatest efficiency is achieved when all activity is directed to keeping the loader busy. The proper location of logging camps is another important factor to be considered. Accurate and detailed cost and production records are of value for indicating operating efficiency.

32.2. *Felling and Related Operations*

32.22 : 33.36.3 : 12.25. SCHMIED, H., and BRAUN, R. Vortrocknung des Fichtenholzes am stehenden Stamm. **[Initial drying of Spruce timber in the standing stem.]** *Cbl. gesamte Forstw.* 68, 1942 (6–28). [G.]

Report on preliminary experiments in Austria to determine to what extent the girdling of Spruce in early

summer (after the swarming of bark beetles), by removal of different widths of bark and phloem, lowers the water content of the stem in the course of a year as compared with ungirdled controls and with trees that are felled, barked by removal of bark and bast along the whole length of the stem, and left lying in the woods with the top of their crowns intact. It is concluded that girdling by removal of a strip 2 m. wide just above the felling point may be justifiable provided the felling is carried out in the following spring shortly before the swarming of the bark beetles; by that time, the water content of the stem is lowered by 50–60 per cent. However, in the case of earlier fellings, girdling is not worth while, since better drying is achieved by felling and barking the trees and leaving them in the forest until the following winter.

32.24 : 32.92–4 : 12.26–8. VALIN, R. Le flottage des bois durs. [**The floating of hardwoods.**] *La Forêt Québecoise* 4, 1942 (209–12). [F.]

Note on the Finnish technique of drying Birch timber previous to floating by felling the trees in leaf and allowing them to dry out before cross-cutting.

32.25 : 07.7. ORSDEL, J. P. VAN. **Power saws in the forests.** *W. Cst. Lumberm.* 69 (4), 1942 (63, 81).

Lower stumps, reduction in felling waste, cheaper yarding and cold decking, and the retention of more mature and experienced men on the felling crews are among the advantages resulting from the use of power saws in the western United States.

32.25.5 : 12.25. MCGUIRE, K. **New method of peeling Redwood logs.** *W. Cst. Lumberm.* 69 (5), 1942 (24). [Caspar Lumber Co., Caspar, Calif.]

Peeling at the railway landing rather than in the woods is recommended.

32.29.1. BOYD, G. R. **Clearing land of brush and stumps.** *Fmrs.' Bull. U.S. Dep. Agric.* No. 1526, (revised ed.) 1941. pp. 35. [Bureau of Agricultural Chemistry & Engineering.]

This bulletin discusses in some detail various methods of brush disposal—including grazing, cutting and burning, and ploughing—and of stump removal, including grubbing, burning, pulling, blasting, bulldozing, and decay. Disposal of the stump after removal and choice of method for land clearing are dealt with in two separate sections.

32.8. *Grading and Storage of Wood in the Rough*

32.81 : 12.26–8 : 32.4 : 74.2 : 22.11 : 22.14.2. BROMLEY, W. S. **The use of log grades in appraising lumber values of selectively cut northern hardwood timber.** *Pap. Mich. Acad. Sci. 1940*, 26, 1941 (135–42). [University of Michigan.] L.S.

A comparative study has been made on a hardwood tract at Alberta, Michigan, of timber values as calculated by log grades and mill tallies of the same material. The system of log grading was a slightly modified form of that used by the Lake States Forest Survey. Five different methods of marking—for heavy and light economic selection, and heavy, medium, and light silvicultural selection cuttings, respectively—were applied to the same stand, which was then clear cut. Complete woods and mill records were kept for all the timber. Results showed that:—(1) For each type of cutting deemed to have taken place, for clear cutting, and for the individual species, the use of log grades enabled the appraiser to assess the proportion of total lumber value removed from the stand within 2 per cent. of that shown by the mill tally. (ii) For Yellow Birch, and Elm, the average money value per 1,000 bd. ft. as estimated by log grading agreed within about 2 per cent. with that determined at the mill; for Sugar Maple, however, the log grading gave a value about 15 per cent. too high, apparently due to the presence of mineral stain in the trees on this area. (iii) Though efforts were made to grade the logs as if they were still in the standing tree, there was a tendency to grade too high, owing to the long-butting practices of the cutters and the difficulty of estimating where and how long the logs were to be cut. (iv) Average money values per 1,000 bd. ft. as appraised without log grades were so close to those obtained by the log-grading method that the latter does not appear worth while for application to the entire stand. Nevertheless, in comparing the value of a portion of the stand with that of the whole stand—e.g. in selective cutting—log grading did give more accurate results. Log grading for this purpose could be applied either to the trees cut or to those left, the value of the remainder being obtained by subtraction from that of the whole stand as assessed without log grades.

32.9. *Transport*

32.9 : 38. JONES, H. R. **Planning for forest transportation.** *J. For.* 40, 1942 (296–300). [U.S. Forest Service.]

An account of the method of planning transportation systems in the National Forests of the United States to serve various land-use objectives and forest protection.

32.91 : 38.3. GÉRIN, M. L'espacement économique des chemins de vidange. [**The economic spacing of extraction roads.**] *La Forêt Québecoise* 4, 1942 (225–38). [F.]

A discussion with reference to cordwood operations.

32.91 : 81. **Tractor logging signals.** *W. Cst. Lumberm.* 69 (5), 1942 (10–2).

The system of hand signalling adopted by the Simpson Logging Company, Shelton, Washington, is described.

32.91.22 : 07.7. COLLINS, T. W. **Truck logging.** Loggers Handbook. Vol. I. Truck Logging. 1941. pp. 84–90. [Grande Ronde Pine Co., Pondosa, Oregon.]

Note on factors to be considered in the selection of equipment, on specifications applying to logging trucks in general, and on the use and servicing of trucks.

32.91.22 : 07.7. CRONKHITE, L. J. **Reminders for trailer maintenance.** *Timberman* 43 (6), 1941–42 (44, 46). [Fruehauf Trailer Co.]

Suggestions for keeping logging trailers in efficient operation.

32.91.22 : 07.7. **Loggers Handbook.** Vol. I. Truck Logging.—Papers and addresses presented at the 32nd session, Pacific Logging Congress, Seattle, Washington, October 22–25, 1941. The Pacific Logging Congress, 314 Broadway—Oak Building, Portland, Ore. 1941. pp. 154.

32.91.22 : 07.7. POINTER, R. W. **Trailers for logging trucks.** Loggers Handbook. Vol. I. Truck Logging. 1941. pp. 67–8. [Pointer-Willamette Trailer Equipment Co., Portland, Ore.]

32.91.22 : 07.7. PRATT, R. W. **Log hauling on adverse grades.** *Timberman* 43 (6), 1941–42 (13–5, 40, 42).

Hauling on adverse grades increases the cost of

transportation and reduces the output. Three methods are discussed for maintaining the output over the adverse grade at the potential capacity of the operation as a whole, each method having advantages under certain conditions. The methods include: (1) The use of extra trucks. (2) Reduction in size of loads and operation of shuttle trucks between the landing and the top of the grade in order to build up the loads on the through-trucks for the balance of the trip to the dump. (3) Increasing the power of trucks by installing a booster engine or by using tow trucks.

32.91.22 : 07.7. WACKERMAN, A. E. **Log hauling problems: how the use of trucks has facilitated logging.** *Sth. Lumberm.* 164 (2067), 1942 (43–6).

Owing to its mobility, truck logging has removed one of the greatest obstacles to selective cutting. Practically all logs in the Southern States are now hauled by truck. The article discusses improvements in logging trucks and unloading technique and includes hints on methods of prolonging the service life of tyres.

32.91.22 : 38.3. WACKERMAN, A. E. **Truck logging roads.** *Sth. Lumberm.* 164 (2065), 1942 (51–3).

The main factors governing the location of logging roads in the southern United States are topography, especially as it affects road drainage, and distance between roads, which influences skidding costs.

32.91.22 : 38.3 : 07.7. PARK, K. W. **Truck road construction.** Loggers Handbook. Vol. I. Truck Logging. 1941. pp. 91–103. [R. G. Le Tourneau Inc., Peoria, Ill.]

This paper discusses (1) the tractor-powered machinery used in building low-cost logging roads, such as the bulldozer, angledozer, scraper, and rooter, giving typical performance data and ownership and operating costs; (2) various types of road and cost of construction; (3) factors of road design; (4) effect of trucks on roads.

32.91.22 : 76.1. MCKINLEY, W. H. **Hauling logs by small tractor.** *Pulp Paper Mag. Can.* 43, 1942 (384). [Brown Corporation.]

The use of the tractor reduced the number of horses and men required at the landings, and the cost of hauling was less than if horses had been used. Logs hauled totalled 342,749, with an average content of 3 cu. ft., and the average length of haul was about 2½ miles.

32.92–4 : 33.02 : 32.96. **Loading pulpwood ships by conveyor on scow.** *Pulp Paper Mag. Can.* 43 (7), 1942 (525–6).

33. CONVERSION AND PRESERVATION OF WOOD

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

33.15. Manufacture of Veneers and Laminated Wood. Gluing

33.15. BRIMS, M. J. G. **Adhesive.** *Australian Patent* No. 110,458, Apr. 24, 1940. Chem. Abs. 36 (2351). P.R.

An adhesive for use in plywood and particularly suitable for high-grade veneers is made of, e.g. casein 100, urea 15, H_2O 460 and CH_2O 7·5 lb. Another desirable composition is casein 100, Na_3PO_4 4, urea 15·5, H_2O 480 and CH_2O 8 lb. If desired, the Na_3PO_4 is substituted by a similar quantity of triethanolamine.

33.15. **Cold water glues in warm weather.** *Timberman* 43 (8), 1941–42 (52).

In warm weather these glues should be mixed in cold water, hot air should not be allowed to circulate over glue joints or veneers, and when using warm stock it is advisable to increase the glue spread and decrease the assembly period as much as possible.

33.15. DOFFINÉ, E. Furnier-Verlängerungsverfahren. **[Splicing methods for extending veneers.]** *Holz* 4, 1941 (283–6). [G.g.] P.R.

A discussion of several plywood splicing machines of German make.

33.15. ELMENDORF, A. **Plywood.** *U.S. Patent* No. 2,267,721, Dec. 30, 1941. Chem. Abs. 36 (2653). P.R.

This method for making dry plywood involves assembling a facing veneer that has a moisture content approaching or extending beyond the fibre saturation point and a much drier layer of wood, with glue interposed, engaging all heartwood areas of considerable size in each layer by sapwood areas in the other layer, applying pressure and heat to the assembly to effect bonding and to dry the facing veneer, and preventing contraction of the facing veneer across the grain, while drying, by holding its surface at numerous small areas spaced apart from each other while the remainder of the face remains exposed.

33.15. **Glues for use with wood.** *Tech. Note For. Prod. Lab., Wis.* No. 207, (revised ed.) 1941. pp. 4. P.R.

33.15. KNIGHT, A. G. **Waterproof glues.** *Wood* 6, 1942 (109–12). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

Note on the behaviour of water-resistant plywood glues under various conditions of exposure in the laboratory and in practical use.

33.15. LÜTY, W. (to Th. Goldschmidt Corp.) **Laminated lumber.** *U.S. Patent* No. 2,261,264, Nov. 4, 1941. Chem. Abs. 36 (1162). P.R.

A process is specified for manufacturing laminated lumber in which at least two pieces of fibrous material that differ substantially in hardness are joined by an auxiliary intermediate layer having substantially the same order of hardness as that of the softer of the pieces, the auxiliary layer being of fibrous material which is hardened by pressure but is capable of being softened thereafter. Materials such as different woods or paperboard may be used.

33.15. MENGER, A. (to I.G. Farbenindustrie Akt.-Ges.) **Joining wood, etc.** *German Patent* No. 681,324, Aug. 31, 1939 (Cl. 38c.1.01). Chem. Abs. 36 (2059). P.R.

To join wood and similar materials that cannot be heated, condensation products of urea, thiourea or their derivatives with aldehyde or its polymers and acids, acid salts or acid-yielding compounds are used. The condensation product and the acid, etc., are applied separately between the surfaces and the latter are pressed at ordinary temperatures.

33.15. VENESTA LTD., BROWN, A. C., and ANGEL, T. H. **Composite materials.** *British Patent* No. 520,913, May 7, 1940. Chem. Abs. 36 (1118–9). P.R.

A strong water- and mould-resistant bond can be produced without risk of blowouts between two wood surfaces by applying a tannin and an aldehyde or a compound capable of reacting as an aldehyde, or an initial condensation product of these substances, to one or both surfaces, and converting the substances to a

water-insoluble tannin-aldehyde condensate by subjecting the surfaces to heat and pressure.

33.15. WALKER, W. (to Celanese Corp. of America.) **Panels of wood plies.** *U.S. Patent* No. 2,263,661, Nov. 25, 1941. Chem. Abs. 36 (1411). P.R.

A non-warping panel is formed of plies of wood united by plies of thin paper impregnated with a water-resistant urea-formaldehyde resin and provided with foils of cellulose acetate united to the outer faces by means of nitro-cellulose.

33.15. WILLIAMSON, J. S. **Wood veneer.** *U.S. Patent* No. 2,266,699, Dec. 16, 1941. Chem. Abs. 36 (2388). P.R.

In the manufacture of a veneer, a lamina of wood is cut having a thickness of about 0·017 in. or less, dried, treated on one side with vulcanized rubber, and again dried.

33.15. WOOD, A. D., and LINN, T. G. **Plywoods: their development, manufacture and application.** W. & A. K. Johnston, Ltd., Edinburgh & London. 1942. pp. 472.

General textbooks on plywood and similar products are few in number, and the works of Knight and Wulpi (1927) and Mora (1932), have now been augmented by Messrs. Wood and Linn, who write after long experience in the plywood trade.

There are introductory chapters on the origin and development of plywood and the general physical properties of wood, followed by an excellent account of modern plywood manufacturing processes well illustrated by plates. Part IV treats blockboard in an equally thorough way, and describes curved and bent work and specialist lines, such as metal-faced plywood. The important matter of adhesives is given lengthy treatment.

The authors point out that their data on the plywood-producing countries of the world were compiled prior to the war, as was the chapter on the plywood trade in the United Kingdom. The information is thus almost of historical interest, but it serves to show the magnitude of the plywood industry.

There is a glossary of species used for commercial plywood and decorative veneers, accompanied by clear illustrations, and the appendix contains a list of terms and definitions and a comprehensive set of conversion and other tables together with a good index.

Two chapters on the uses of laminated products in industry are excellent, both in scope and in the detailed manner in which actual methods of employing the materials are set out and illustrated.

There are, of course, minor points that could be criticized; the chapter on improved and compressed woods, for example, is very incomplete. It should be realized, however, that detailed information on such new materials is not generally available, and that development has been rapid during the war years.

The book is surprisingly well printed and bound, and can be thoroughly recommended for general study and reference.

R. A. G. KNIGHT.

33.15. ZAYARNYĬ, V. I. **A new water-resistant adhesive for wooden constructions.** *Rabochiĭ Stroitel* 1939 (9), (41–3); *Khim. Referat Zhur.* 1940 (1), (134–5). Chem. Abs. 36 (2042). P.R.

'Kedron' joining adhesive is made by dissolving 1 part by weight of celluloid in 5 parts of butyl acetate. It resists an average pulling weight of 29 kg./sq. cm. for 14 days. The strength of the joint increases with time. 'Kedron' can be used on wet wood. The consumption of 'Kedron' is 1 litre-full per 1 sq. m. of the joined surface.

33.15 : 07.7. PERRY, T. D. **Resin adhesives give impetus to improved plywood machinery.** *Wood Products* 47 (4), 1942 (33–4 36–8). [Resinous Products & Chemical Co., Inc., Philadelphia.]

Notes on some machines and accessories that have come into recent use in the plywood and allied industries as a result of developments with thermo-setting resin glues.

33.15 : 12.26–8 (410). COX, H. A. **Home-grown Poplar.** *Wood* 6, 1942 (117). [Forest Products Laboratory, Princes Risborough, Bucks.]

In a recent investigation, veneers were obtained without difficulty from British-grown × *P. serotina* and × *P. robusta*. The quality of plywood from these veneers compared favourably with that of imported Cottonwood plywood used for box-board manufacture and similar non-exacting purposes.

33.15 : 31.0 : 12.25. **War uses for Douglas Fir plywood.** *Timberman* 43 (7), 1941–42 (52, 54).

A list of present uses in the U.S.A.

33.15 : 31.0 (54). **Third interim report on work under Proj. VIII (Testing of Indian timbers for veneers and plywood).** *Indian For. Rec.* (*n.s.*) *Utilisation* 2, 1941 (iv + 77–106). [Forest Research Institute, Dehra Dun.]

A supplement to the first and second *interim* reports on the testing of Indian timbers for veneer and plywood that were published in 1934 and 1936 respectively. The present report records the qualities and peculiarities of the timber of each of 34 species, with special reference to its possible use or non-suitability for rotary-cut veneers and plywood, and includes further tests on species dealt with in the earlier reports.

33.15 : 31.21.4 : 31.27. JERVIS, A. E. L. **Laminated densified wood: insulating properties and tooling applications.** *Elect. Rev., Lond.* 130, 1942 (395–7). L.S.

With main reference to the insulating and strength properties and uses of two products manufactured by Moulded Components (Jablo) Ltd.

33.15 : 31.22. HAWKINS, R. S. **Water absorption of resin impregnated Oregon Pine.** *British Plastics & Moulded Products Trader* 13, 1942 (406, 408). L.S.

Plies of Oregon Pine (*Pseudotsuga taxifolia*) wood were treated by immersion at room temperature in three types of resin—water-soluble phenolic BR5995 (50 per cent. aqueous solution by weight), phenolic BV1457 CLR (100 g. resin per 100 g. alcohol), and phenolic BV1115 (100 g. resin per 33 g. alcohol). The period of immersion was also varied. After removal and drying, all samples were oven-cured at 300° F.; following this they were placed in water and their absorption and dimensional changes recorded. Results, which are tabulated in detail, showed that the water-soluble phenolic resin was noticeably better than the others tested and that longer periods of immersion in resins diminished water absorption.

33.17. Sawmilling

33.17 : 07.7. DEVER, J. F. **Care of small circular saws.** *Timberman* 43 (8), 1941–42 (56, 58).

33.17 : 07.7. DEVER, J. F. **Double cut band saws.** *Timberman* 43 (7), 1941–42 (36).

Note on the advantages of these saws and hints regarding their use.

33.17 : 07.7. **Smooth sawed lumber: new technique developed at Bridal Veil Lumber & Box Co.** *W. Cst. Lumberm.* 69 (5), 1942 (36–7).

The system of smooth sawing developed by A. and E. Ferrari is now in operation at this Oregon mill. Smooth-sawn boards are almost indistinguishable from planed boards. The system is suitable for dry softwood timber of small or medium dimension, and is cheaper and less wasteful in raw material than planing.

33.3. *Chemical Treatment*

33.3 : 33.8 : 12.26–8. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

Tests show that heavy soaking of hammer handles of Yon (*Anogeissus acuminata*) in oil does not increase their strength though slight surface oiling is useful in reducing surface checking and making the handle smoother (p. 51).

33.3 : 34.6. GRANT, J. **Chemical production from wood.** *International Export Chemist* 23, 1942 (179–83, 188). L.S.

A review, discussing in brief the chemical composition of wood, the isolation of lignin, the utilization of waste liquors obtained in pulp manufacture, saccharification, and various other processes that show some promise. 21 references are quoted.

33.32. Pulp and Paper Manufacture. Plastics

33.32. KLINT, BERNHARDT & CO. **Ready-made building parts from wood fibre.** *British Patent* No. 538,342, July 30, 1941. Chem. Abs. 36 (1459). P.R.

Wood fibre or pulp that has been impregnated with heat-resisting, thermo-setting phenol-formaldehyde resin or a heat-resisting, thermo-hardenable mixture of urea resin with glycerol-phthalic anhydride resin is subjected to heat treatment with simultaneous mechanical pressing. The surface of the moulded and impregnated material after heat treatment and without the use of an undercoating is provided with a baked surface coating of a thermo-setting baking enamel containing a glycerol-phthalic anhydride resin.

33.32. MALZ, A. **Plates, etc., made of ground wood and sodium silicate.** *German Patent* No. 704,836, Mar. 6, 1941 (Cl. 80*b*.9.09). Chem. Abs. 36 (2113–4). P.R.

Ground wood or similar material is fed between rolls. Behind the first pair of rolls the material is sprayed from above and beneath with sodium silicate, subsequently passing through further sets of rolls to effect compression and finally between burners producing a flame of approximately 800°. The material hardens in the flame and is later cut as desired.

33.32 : 07.2 : 33.39 : 34.6. HÄGGLUND, E. Redogörelse för forskningsverksamheten vid Cellulosalaboratoriet under 1941. **[Report on research activities at the Cellulose Laboratory during 1941.]** *Svensk PappTidn.* 45, 1942 (123–35). [Sw.e.g.] [Cellulosaindustriens Centrallaboratorium, Stockholm.] P.O.

This lecture briefly reviews work done at the Central Laboratory of the Swedish Cellulose Industry during the year. Subjects dealt with are the saccharification of cellulose by strong sulphuric and by hydrochloric acid; the chemistry of the sulphite process with regard to the properties of lignosulphonic acid and to changes in sugar compounds during the cook; the chemistry of sulphite waste liquor; sulphate or soda cooking conditions necessary to produce pulp with a TAPPI viscosity of 20 cp.; separation of resin and fatty acid from sulphate soap; and work on analytical methods. Red rot due to *Polyporus annosus* was found to lower the yield and strength of sulphite pulp from Spruce wood, but no appreciable loss in quality could be determined in rayon pulp produced from such wood.

33.32 : 07.7. SAMSON, T. Om huggning av flis. **[On the cutting of chips.]** *Svensk PappTidn.* 45, 1942 (175–82). [Sw.g.e.] P.O.

An attempt is made to treat the process of wood cutting in a chipper from a theoretical point of view. Extensive reference is made to a new type of chipper patented in the U.S.A. by P. N. Ottersland, of the Carthage Machine Company.

33.32 : 12.26–8. KLAUDITZ, W. Zur Zellulosegewinnung aus Laubholz. **[On the production of cellulose from hardwoods.]** *Holz* 4, 1941 (314–25). [G.g.] [Chemisch-Technologisches Institut der Reichsanstalt für Holzforschung, Eberswalde.] P.R.

A combined process, claimed to have the advantages of both the sulphite and the soda processes, is advocated for the pulping of hardwoods. In the new process the wood is first cooked with dilute mineral acid in order to hydrolyze resistant pentosans. This is followed by an alkaline cook.

33.32 : 12.26–8 : 12.25. CHEN, W.-H. W., and CAMERON, F. K. **Cellulose content of cotton and Southern woods.** *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (224–5). [University of North Carolina, Chapel Hill.] L.S.

A table is included to show the colour of pulp, relative ease of breakdown of chips, bleachability, and total and alpha-cellulose contents of 15 woods from the south-eastern United States. The alpha-cellulose contents of the woods were generally lower than that of whole cotton but comparable to that of cotton stems and cusps.

33.32 : 31.3. CHARBONNIER, H. Y. **Lignins isolated in the presence of butanol.** *Paper Tr. J.* 114 (11), 1942 (31–6). [Union Bag & Paper Co., Sawannah, Ga.] P.R.

33.32 : 31.3. LEACH, W. G. **Differentiation of chemical and mechanical wood fibres.** *Analyst* 66, 1941 (415). Chem. Abs. 36 (902). P.R.

The use of a solution of 'Coomassie Brilliant blue FF 200' has proved satisfactory as a substitute for the Schultze staining method. The technique is the same as with the latter method, but in the new test mechanical wood fibres are stained blue-black and chemical wood fibres red-brown.

33.32 : 31.42.11. RENNERFELT, E. **Das Wachstum** einiger Fäulnispilze auf Holzschliff. **[The growth of some wood-destroying fungi on mechanical wood pulp.]** *Svensk bot. Tidskr.* 36, 1942 (301–11). [G.g.] L.S.

33.32 : 31.42.1 : 33.36.1. RENNERFELT, E. **Chemical treatment of wet mechanical pulp in order to control damages caused by fungi.** *Svenska SkogsvFören. Tidskr.* 39, 1941 (19–94). [E.sw.] R.A.M.21 (314).

33.32 : 33.06 : 07.7. WARD, A. T. **Treating logs for conversion into pulp for paper mills.** *U.S. Patent* No. 2,264,421, Dec. 2, 1941. Chem. Abs. 36 (1778). P.R.

A description is given of apparatus and of a process that involves roughly barking the logs, subjecting them to a cleansing solution, scrubbing to remove gritty substances and residual bark, reducing to chips and then to smaller chips, grading the chips to produce relatively clean chips of approximately uniform size, advancing these in dry condition and in a relatively loose layer of approximately uniform thickness along a reciprocable table provided with riffles, and subjecting the layer to penetrating jets of air to remove pneumatically the objectionably light and heavy materials from the good chips.

33.32 : 33.15. STEVENS, W. C., and TURNER, N. **Chemical bending: the influence of urea treatments on the bending and setting properties of wood laminations.** *Wood* 7, 1942 (123–6). [Forest Products Research Laboratory, Princes Risborough, Bucks.]

The results of tests on British-grown Oak and Beech and imported Sitka Spruce tend to confirm the claim made that urea-treated wood heated in an oven can readily be bent, but they indicate further that the degree of flexibility achieved is no greater than would result from immersing the material in boiling water. Both urea-treated and boiled specimens when bent to destruction exhibited the same type of failure at approximately the same radius of curvature, and there was no indication that the tendency for a wood such as Sitka Spruce to fail in compression as a result of bending was in any way diminished by the presence of the urea. The time required for urea-treated bends to 'set' was undoubtedly very much shorter than that required to set bends made from material previously treated in boiling water. This advantage, however, would be more than offset in general by the greatly increased hygroscopic properties of the urea-treated wood, and the consequent extreme instability of bends made from such material when subjected to fluctuating atmospheric conditions. Apart from other considerations such as cost of treatment, etc., it does not appear, therefore, that the production of laminated bends from urea-treated material offers any appreciable advantage over the more usual method of bending the laminations after a short immersion period in boiling water.

33.32 : 34.26 : 12.25. BOTTO-MICCA, G. **Utilization of liquid resin (tall oil) of Pine wood.** *Chimica e industria* 23, 1941 (362–5) Chem. Abs. 36 (1492). P.R.

Data on the composition of the resin contituents of Pine wood obtained as soaps in cellulose manufacture.

33.32 : 34.6. DYNAMIT-AKT.-GES. VORM ALFRED NOREL & CO. **Moulded pieces obtained from wood waste.** *French Patent* No. 851,952, Jan. 19, 1940. Chem. Abs. 36 (2045). P.R.

Wood waste is mixed with a hardenable artificial resin and compressed in a heated mould until completely hard. The amount of artificial resin to be added is 2–10 per cent. of the weight of the wood waste.

33.32 : 34.6 : 01.2. AVELIUS, N. Tallsyra: ett nomenklaturförslag. **[Tall acid: a proposed nomenclature.]** *Svensk PappTidn.* 45, 1942 (203–5). [Sw.e.g.] P.O.

Proposed nomenclature in Swedish, English, and German, of sulphate soap (tall oil) and its products, compiled on the basis of answers to a questionnaire issued by the Swedish Technical Nomenclature Centre (Tekniska Nomenklaturcentralen).

33.32 : 34.6 : 34.24. GUSTAVSON, K. H. Sulfitlut som råvarukälla för garvämnen. **[Sulphite liquor as a source of raw material for tanstuffs.]** *Svensk PappTidn.* 45, 1942 (193–200). [Sw.sw.e.g.] P.O.

The use of lignosulphonic acid compounds, derived from the purification of waste sulphite liquor, is reviewed from the standpoint of their role as auxiliary agents in the vegetable tanning of heavy hides. *From author's summary.*

33.32 : 34.6 : 34.26. GÖTHNER, I. Om destillation av flytande harts. **[On the distillation of 'liquid resin'.]** *Svensk PappTidn.* 45, 1942 (169–73). [Sw.g.e.] P.O.

A description is given of the process and plant used at the Bergvik and Ala Company's sulphate mill at Sandarne, Sweden, for obtaining products such as tall oil, resins, pitch, and fuel oil from the liquid resin produced from the soapy scum of black liquor. The plant is capable of dealing with 6,500–7,000 tons of raw sulphate soap per annum.

33.36. Preservation of Wood. Seasoning and Drying

33.36 : 12.25. I.G. FARBENIND. A.-G. **Removing resin from Pine wood.** *French Patent* No. 853,281, Mar. 14, 1940. Chem. Abs. 36 (2389–90). P.R.

Elimination of resin is effected by adding to the wood, during or after the pumicing, small quantities of a metasilicate of an alkali metal in the form of an aqueous solution or as a powder.

33.36 : 33.31 : 31.46. ÉTABLISSEMENTS BETTS AND BLANCHARD (Bordeaux). **Wood and cork: waterproofing.** *British Patent* No. 543,487, Feb. 27, 1942. Cotton Res. Summ. 22 (189). P.R.

Impregnation with a solution comprising a mixture of water-soluble salts of a fatty acid and a fatty hydroxy acid, e.g. a mixture of sodium palmitate and ricinoleate, is followed by treatment with a solution of a metallic salt, e.g. a salt of an alkaline-earth metal or of aluminium, which is able to react with the salts of the fatty acid and the fatty hydroxy acid to form an insoluble metallic soap.

33.36.1. *Preservation against Attack by Plants and Animals*

33.36.1. GUSTAFSSON, C. (to Johan Bjorksten). **Impregnating wood, etc. for preservation.** *U.S. Patent* No. 2,261,758, Nov. 4, 1941. Chem. Abs. 36 (1162). P.R.

Underlying a covering coat of paint, wood or fibreboard, etc. is impregnated with a composition prepared by chlorinating substantially to saturation, a distillate of a vapour-phase cracked petroleum product, the distillate being substantially unsaturated and having a boiling range below 300° at atmospheric pressure, and polymerizing the chlorinated material by the use of a Friedel-Crafts type catalyst.

33.36.1 (729.7) : 31.4. BROOKS, R. L. **The preservation of timber.**—With discussion. *Journal of the Institute of Petroleum* 28, 1942 (63–81). [Conservator of Forests, Trinidad.] L.S.

A brief review is made of fungi and insects destructive to wood and of preventive and control measures, including wood preservatives and methods for their application. Appendices deal with the resistance to fungi and

termites of local and imported timbers in Trinidad, suggestions for the increased use in Trinidad of local timber cut during clearing operations by petroleum companies, and a tabular summary of test results for treated timber of various species.

33.36.1 : 31.42.11 : 12.2N. HARDY, E. **Dry rot in the textile industry.** *Text. Rec.* 59, 1942 (38). R.A.M. 21 (315).

Dry rot (*Merulius lacrymans* and other fungi) is exceptionally prevalent in the woodwork of textile factories, where the normal methods of control by reducing humidity and temperature are not ordinarily practicable. Prevention must be based primarily on the use of resistant woods, e.g. Rhodesian, Burma, Nigerian, or Borneo Teak, Tallow-Wood, Deodar, Juniper, Californian Redwood, Southern Cypress, Yew, Larch, Jarrah, Western Red Cedar, Port Orford Cedar, or Yellow Cedar. For preservation the author recommends a reliable chemical antiseptic such as solutions of arsenical salts, two coats of hot creosote (140° F.), 2 per cent. Wolman salts (triolith), 2 per cent. sodium fluoride, copper sulphate, or zinc chloride. White lead plus zinc chrome (2 per cent.) is the best paint for use in textile factories where moulds are prevalent. Zinc oxide is also a good preservative, and before re-painting a treatment with 1:100 sodium pentachlorphenate is advised. Black fungal spotting on paint-work may be removed with soapy water containing carbolic acid and formalin, followed by 1 per cent. mercuric chloride.

33.36.1 : 31.42.12. **Cause and prevention of blue stain in wood.** *Tech. Note For. Prod. Lab., Wis.* No. 225, (revised ed.) 1941. pp. 4. P.R.

33.36.1 : 31.43. GEORGE, R. A. ST. **Protection of log cabins, rustic work, and unseasoned wood from injurious insects.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1582, (revised ed.) 1941. pp. 22. [Bureau of Entomology and Plant Quarantine.]

Insects responsible for damage to wood of this type include bark beetles, ambrosia beetles, powder-post beetles, roundheaded borers and flatheaded borers. Brief notes are given on life history and seasonal activity of and damage done by these insects, conditions favourable and unfavourable for attack and preventive and control measures.

33.36.1 : 31.43 : 13.2. EVANS, J. W. **Timber borers.** *Tasm. agric. J.* 12, 1941 (98–100). R.A.E. A50 (271–2).

Injury to furniture and timber in buildings in Tasmania is commonly caused by *Lyctus brunneus* Steph. and *Anobium punctatum* de G. The former attacks partly seasoned and recently seasoned sapwood; it cannot initiate infestation in well seasoned timber, though it may continue to develop in it. Almost all commercial Australian hardwoods are liable to attack, but softwoods are immune. *A. punctatum* infests both sapwood and heartwood of old, well seasoned timber; it attacks various hardwoods and softwoods, but not *Eucalyptus*. Control measures include brushing or spraying during spring and early summer, when most of the insects are just below the surface, with suitable insecticides, of which the best is creosote, or, if the wood must not be stained, a 5-per-cent. solution of paradichlorobenzene in kerosene. Either may be injected into holes in polished furniture with a syringe, and the holes may be filled after treatment with a stained 2:1 mixture of beeswax and resin.

33.36.1 : 31.43 : 13.2. MUIRHEAD, D. M. **A beetle control problem in timbers of the Old South Meeting House.** *J. econ. Ent.* 34, 1941 (381–3). R.A.E. A30 (184).

Xestobium rufovillosum de G. was successfully eradicated from old Oak timbers of a building in Boston by providing adequate ventilation to reduce humidity and so prevent decay, cleaning the timbers thoroughly, removing frass from the beetle galleries by suction, and treating the wood first with orthodichlorobenzene and then with a light creosote, both of which were forced into all galleries, crevices and peg holes under pressure and applied to all surfaces with a spray gun.

33.36.1 : 31.43 : 13.2. SNYDER, T. E. **Control of ambrosia beetles.** *Sth. For. Notes* No. 39, 1941 (3).

Chemicals effective against ambrosia beetles include dichlorodiphenyloxide and parachlorphenoxy-ethoxy-ethyl-chloride, both of which must be diluted in kerosene. End-racking of green lumber for 8–15 days before placing in flat piles will reduce the moisture content below the point at which it is attractive to the beetles.

33.36.1 : 31.43 : 13.2. WILSON, H. B. **Borers in Australian hardwood timbers for joinery and furniture.** *Aust. Timb. J.* 8, 1942–3 (621, 623). [Division of Forest Products, C.S.I.R.]

Note on the damage caused by pinhole and powder-post borers and on the prevention and control of *Lyctus* attack.

33.36.1 : 33.31. ALLGEMEINE HOLZIMPRÄGNIERUNG GESELLSCHAFT M.B.H. **Preserving wood.** *French Patent* No. 851,830, Jan. 16, 1940. Chem. Abs. 36 (2114). P.R.

Alkali metal or alkaline earth polyphosphates are added to protective salt mixtures containing fluorine.

33.36.1 : 33.31. NARAYANAMURTI, D., and RANGANATHAN, V. **Studies on coal tar creosote as a wood preservative. Part I.—Creosote extracted from timbers in service.** *Indian For. Bull. (n.s.) Utilisation* No. 104, 1942. pp. 18. [Forest Research Institute, Dehra Dun.]

The bulletin describes in detail some experiments on the nature of creosote extracted from several sleepers and posts which had been in service for a number of years. The composition of creosote extracted varied in different sleepers and different portions of the same sleeper. The specific gravity of the creosote was generally higher in the outer sections of the sleeper. Oil extracted from the outer layers and the sides of the sleeper generally yielded a higher residue. Tar acids were not entirely leached even after long service. Leaching was more marked at the bottom of the sleeper while evaporation and oxidative changes were greater in the top and outer layers. In posts, the specific gravity of the creosote tended to increase from the bottom upwards, while the concentration tended to decrease.

33.36.1 : 33.31 : 31.42.11. MARTÍNEZ, J. B. Determinación del valor eficaz de un antiseptico.—Con un apéndice sobre la técnica de cultivo de los hongos destructores de la madera. **[Determination of the efficacy of a preservative.—With an appendix on the technique of culturing wood-destroying fungi.]** Instituto Forestal de Investigaciones y Experiencias, Madrid. 10 (17), 1939. pp. 50. [Span.]

33.36.1 : 33.31 : 31.42.12. FLENNER, A. L., and KAUFERT, F. H. (to E. I. Dupont de Nemours & Co.) **Preserving wood.** *U.S. Patent* No. 2,268,387, Dec. 30, 1941. Chem. Abs. 36 (2704). P.R.

For the control of blue-staining fungi on green wood or lumber, the latter are treated with ethyl Hg phosphate in a very dilute aqueous solution made alkaline by the hydrolysis of borax, which is used in sufficient amount to prevent corrosion and Fe tannate staining.

33.36.1 : 33.51. NICHOL, C. W. **Treated timber for coal mines.** *South African Mining & Engineering Journal* 52, 1941 (660–1). L.S.

The relative value of wolman salts in the preservation of mining timbers, method of its application and economies of its use are discussed briefly.

33.36.1 : 33.53. BENNETT, R. G. **Wood preservation in the service of the British Post Office.**—with discussion. *Proc. Soc. Chem. Ind.* (*Chem. Engng. Group*) 22, 1940 (40–5). L.S.

A short account is given of the history and methods of wood preservation as practised by the British Post Office, with main reference to telegraph poles. Though other preservatives and timbers have been and are being tried, creosoted Scots Pine has long been the standard material for this purpose and creosote has so far met the preservative requirements better than any other preparation. Since 1913 the standard treatment has been Rüping's empty-cell process, which has the advantages of economy and cleanliness. The creosote used conforms to the British Standard Specification 144 and the retention secured is about 4 lb. per cu. ft. of wood. Special attention is paid to the seasoning of the timber and to the execution of all necessary boring and cutting before creosoting is done. The Post Office works in close association with the Forest Products Research Laboratory and some notes are included on work at the latter institution on creosote specifications and analyses of creosote from poles that had been in service for 18–57 years.

33.36.1 : 33.53 : 12.25. HARKOM, J. F., COLLEARY, M. J., and SEDZIAK, H. **Results of the examination of six ground line treatments on Eastern White Cedar poles after two years' service.** Forest Products Laboratories, Ottawa. 1942. pp.18. P.R.

The data given in this report relate to treatments with creosote alone, sodium fluoride, dinitrophenol, potassium dichromate and creosote, and creosote with sodium fluoride, with special reference to the degree of penetration of the preservatives as determined after two years' service. Definite conclusions on the relative effectiveness of the different treatments cannot be drawn after this period, though all treatments seemed to inhibit decay at the ground line for the two years and the creosote/sodium fluoride treatments appeared to be the most promising.

33.36.2. *Fireproofing*

33.36.2. LEFEBURE, V., and DOUGLAS, A. H. (to Imperial Chemical Industries Ltd.). **Fire-resisting calcium sulfate plaster casing for beams and columns of buildings.** *U.S. Patent* No. 2,267,929, Dec. 30, 1941. Chem. Abs. 36 (2703–4). P.R.

An outer casing of set $CaSO_4$ plaster of at least 0·75 in. thickness is used and has, bonded to its inner surface, a backing of strong nonwoven fibrous sheet material such as a gypsum plasterboard spaced from the beam or column to be protected so as to provide air spaces.

33.36.2 : 33.31. **Fire-retarding paints.** U.S. Forest Products Laboratory, Madison, Wis. No. *R*1280, 1941. pp. 4. P.R.

33.36.3. *Seasoning. Drying*

33.36.3. Betriebsmittel für Anlagen zur künstlichen Trocknung. [**Means of heating for kiln-drying plants.**] *Holztechnik* 22, 1942 (69–70). [G.]

33.36.3. **The air-seasoning of converted green timber.** *Leafl. For. Prod. Res. Lab.* No. 21, 1942. pp. 6. [Forest Products Research Laboratory, Princes Risborough, Bucks.]

An outline of essential principles of air-seasoning under British conditions.

33.36.3 : 07.7. Die trocknungs- und lüftungstechnische Ausrüstung von Anlagen zur künstlichen Trocknung. [**The technical drying and aeration equipment of kiln-drying plants.**] *Holztechnik* 22, 1942 (68–9). [G.]

33.36.3 : 07.7. GLÜCKLICH, E. Materialfragen bei der Einrichtung von Trockenanlagen. [**Problems of material in the establishment of kiln-drying plants.**] *Holztechnik* 22, 1942 (65–6). [G.]

It is argued that the physical and chemical properties of asbestos-cement plates (consisting chiefly of standard Portland cement with small admixtures of asbestos fibres) such as 'Eternit', 'Toschi', etc. in no way preclude their use as substitute materials for the walling of drying kilns.

33.36.3 : 07.7. REHMAN, M. A. **Types of timber seasoning kilns suitable for drying Indian woods.** *Indian For. Leafl.* (*Utilisation*) No. 11, 1942. pp. 5. [Forest Research Institute, Dehra Dun.] P.R.

33.36.3 : 07.7 : 33.15. REHMAN, M. A., and MOHAMMAD, S. **A new type of veneer drying rack.** *Indian For. Leafl.* (*Utilisation*) No. 7, 1941. pp. 4 + plate. [Forest Research Institute, Dehra Dun.] P.R.

33.36.3 : 07.7 : 33.8. REHMAN, M. A. **Note on a hot air kiln for seasoning half-wroughts of shuttles, bobbins, helves, picker-arms, etc.** *Indian For. Leafl.* (*Utilisation*) No. 5, 1941. pp. 6. [Forest Research Institute, Dehra Dun.] P.R.

33.36.3 : 31.22.1 : 07.7. SCHWARTZ, A. Feuchtigkeitsmessung mittels Farbenhygroskopes. [**Moisture measurement by means of a colorimetric hygroscope.**] *Dtsch. Holzwirtsch.* 58 (81), 1941. [G.] *Abstr.* in *Holz* 4, 1941 (293). [G.] P.R.

The phenomenon of colour change in certain metallic salts with change in atmospheric humidity is the basis of measurement with the 'Diakun' apparatus. The most effective salt for this purpose is cobaltous chloride. To reduce errors of measurement in colour comparison the author suggests that observation should be made through a red filter, impermeable to blue rays, so that differences in brightness would be measured instead of colour tones. The construction of a colorimetric hygroscope is described.

33.36.3 : 33.31. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp.161.

Half-wroughts of mallet heads and jute-mill rollers of *Acacia arabica* that had been boiled in a 50-per-cent.

solution of molasses or in a 15-per-cent. solution of common salt for 3½ hours and allowed to remain in solution for 24 hours after boiling showed much less cracking during subsequent air drying than did untreated controls. Soaking in a saturated solution of common salt for six days prior to air seasoning was even more effective (p. 62). Coating ends of mallet heads with paraffin wax prevented cracking during air drying and a brush-coating of glycerine also proved advantageous though linseed oil had no effect (p. 70).

33.36.3 : 33.31. MOTTET, A. L. **Chemical seasoning of forest products.** *W. Cst. Lumberm.* 69 (6), 1942 (26, 44–5). [W. Coast Lumbermen's Association.]

General discussion of the causes of checking in seasoning lumber and of its prevention by the use of chemicals. While urea is in general the most satisfactory agent for chemical seasoning, it has the disadvantage of imparting a grayish green colour to Fir and Hemlock sapwood and of causing a slight darkening of heartwood in kiln drying. Diethylene glycol does not have this disadvantage but its cost is double that of urea. Invert sugar, while not satisfactory to use alone, is exceptionally effective in combination with more hygroscopic chemicals such as urea. For economic reasons the 'dry-spread method' of applying chemicals is advocated—the solid chemical being applied to the surface of green lumber in such a manner that it will dissolve in the wood moisture and diffuse in. In using this method the lumber should be treated soon after sawing, and the solid-piled, treated lumber must be protected as much as possible from drying.

33.36.3 : 33.31. WALKINGTON, D. **Crystal urea affords new seasoning control.** *B.C. Lumberm.* 26 (4), 1942 (25–7, 36). [Canadian Industries, Ltd.]

The advantages of urea over other substances for use in chemical seasoning are listed. The properties of urea are noted, and methods of application, economies of use, and results of tests and mill experience, are discussed in detail.

33.36.3 : 33.4. SCHLÜTER, R. Trocknung von Bauholz. **[Drying of structural timber.]** *Holz* 4, 1941 (279–83). [G.g.] P.R.

The productive capacity of the drying kilns of Germany does not suffice for the seasoning of building timber of large cross-section. The adoption of a standardized kiln design for the drying of building timber and Government-sponsored mass production of kilns of such design are advocated.

33.36.3 : 33.52 : 12.25. REHMAN, M. A. **Experiment on the air seasoning of *Pinus longifolia* (Chir) sleepers in the East Almorah Division, U.P.** *Indian For. Rec.* (*n.s.*) *Utilisation* 2, 1941 (v + 109–49). [Forest Research Institute, Dehra Dun.]

From the experiments described in this bulletin it was found that: (*a*) Sleepers converted in winter months and removed from the forest to the launching depots within a week or so after conversion had a moisture content of 66–67 per cent., whereas those converted in the hot season and removed from the forest within about a week had a moisture content of about 38 per cent. By the following August moisture content had been reduced to 45 and 36 per cent. respectively. All sleepers had a moisture content of about 80 per cent. after four months in the river. They attained air-dry condition (15 per cent. moisture content) after they had been stacked for about six months. (*b*) Sleepers converted in hot weather are liable to severe cracking if exposed to the sun for a long time. There is no advantage in removing winter-cut sleepers from the forest immediately after conversion as against the present practice of allowing them to lie scattered in the forest for a month or two. (*c*) Sleepers obtained from big sound trees are less liable to cracking and twisting than those obtained from a poor type of forest. (*d*) There is no advantage in the use of a saw over an axe for cross-cutting logs as regards end-splitting. (*e*) Coal tar and Chir (Pine) tar applied to the ends of the sleepers soon after conversion are effective in preventing end-splitting. (*f*) The situation of launching depots is an important factor in the cracking and splitting of sleepers while stacked in the forest, and in the development of rot.

Suggestions are made for improving the exploitation of Chir Pine in the Kumaon Hills. *From author's summary.*

33.37. Distillation. Manufacture of Tar

33.37 : 12.25. INDIA and BURMA. **Forest research in India and Burma, 1940–41. Pt. I.—The Forest Research Institute.** Manager of Publications, Delhi. 1941. pp. 161.

Experiment has shown that certain objectionable characteristics of Chir tar can be removed by redistillation, thus fully decomposing the large proportion of free and partially decomposed resins that it normally contains (p. 121).

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-Gas Generators

33.38.1. MARIAN, S. **Forestry charcoal production.** *Quart. J. For.* 36, 1942 (54–9).

A brief discussion of the factors affecting the profitableness of forest charcoal production in Britain under the present conditions.

33.38.1 (74.2). BALDWIN, H. I., and WELD, E. A. **Charcoal-making in New Hampshire.** *Fox For. Notes* No. 31, 1941. p. 1.

Production of charcoal, made from waste wood, debris, and thinnings from young stands, burnt in portable steel drum kilns, averaged 52 bu. per cord for Pine and 42 bu. per cord for hardwood. It is considered an admirable fuel for picnic fires.

33.38.1 : 07.7. BARBEY, A. Le 'Carbufor'. **[The 'Carbufor' charcoal kiln.]** *J. for. suisse* 92, 1941 (210–1). [F.]

Note on a small kiln yielding 100 kg. charcoal per burn, the material used being coniferous branchwood.

33.38.1 : 07.7. OLSON, A. R., and HICOCK, H. W. **A portable charcoal kiln using the chimney principle.** *Bull. Conn. agric. Exp. Sta.* No. 448, 1941. pp. 486–513.

Design and operation of 1-cord and 4-cord kilns.

33.38.1 : 33.38.2. BIRCH, T. T. C. **Charcoal manufacture for producer gas.** *Gen. Publ. Ser. N.Z. St. For. Serv.* No. 1, 1942. pp. 15. [N.Z. State Forest Service.] P.R.

33.38.1 : 33.38.2 (54). **Producer gas for motor vehicles: supply of charcoal.** Govt. of India Press, New Delhi. 1942. pp. 12.

A discussion with reference to India. Steps are being taken to organize production of charcoal for producer-gas use.

33.38.1 : 33.38.2 (54). RAMASWAMI, S. **Charcoal for producer gas for lorries and buses.** *Indian For. Leafl.* (*Utilisation*) No. 9, 1942. pp. 6.

It is estimated that about one-half of the commercial lorries and buses of British India, of which there are over 37,000, might be usefully converted to producer-gas operation. Some 18,000 tons of charcoal would be required per month; the production of this amount should not be beyond the capacity of India. The leaflet includes a list of species thought to be suitable for charcoal burning.

33.38.1 : 34.6. HAEGERMÄRK, Y. R. **[Briquettes from sawdust, wood waste or peat.]** *Swedish Patents* No. 101,841 and 101,842, June 23, 1941. *Oel u. Kohle* 38, 1942 (Sch. 88). [G.] P.O.

(i) Sawdust, wood waste, or peat can be briquetted, with the addition of charcoal powder if necessary by pressing under heat in such a manner that the outer layers of the pressed briquettes become plastic but harden and hold the briquettes together on subsequent cooling. The briquettes thus obtained are then carbonized. Pressing is carried out at about 160–170° C. (ii) A number of briquettes may be pressed in the same pressing chamber, the individual layers being separated by pre-heated iron plates which provide the necessary heat.

33.38.1 : 34.6. SPATZ, R. **[Coke briquettes from plant materials.]** *German Patent* No. 715,364, Dec. 19, 1941. *Oel u. Kohle* 38, 1942 (Sch. 72) [G.] P.O.

For the manufacture of coke briquettes from wood or other non-fossil plant materials the raw material is first heated to about 300° C., and when the exothermic reaction is over the temperature is rapidly increased to about 600° C. The rapid heating serves to retain a large part of the hydrocarbons in the mass. The mass is then slowly cooled and pulverized, just sufficient tar is added to secure a granular consistency, followed by pressing into briquettes and carbonizing at temperatures up to 1,000° C. The briquettes are practically free from tar, acids, resin and the like, have a high calorific value, and are specially suitable for use in producer-gas vehicles.

33.38.2 : 33.06 : 33.1 : 33.36.3. LANZ, C. Die Herstellung von Gasholz. Zerkleinerung, Trocknung und Lagerung von Holz als Treibstoff. **[The manufacture of producer wood. Conversion, drying and storage of wood for use as a motor fuel.]** Schweizerischer Verband für Waldwirtschaft, Forstwirtschaftliche Zentralstelle der Schweiz, Solothurn. [1941?]. pp. 85 + tbls. [G.f.]

Includes data on the cost, under Swiss conditions, of producer-wood manufacture using different conversion and drying methods. The acquisition of special machinery for conversion is profitable only if a demand of at least 100 tons per annum for several years can be relied upon; otherwise timber firms are advised to use their ordinary band saws or circular saws. Among special conversion machinery of Swiss make, the chopping machine manufactured by Messrs. U. Ammann, Langenthal, and the Velox saw made by Messrs. Jonneret Fils ainé, Geneva, proved efficient and comparatively inexpensive in the conversion of small-diameter thinning material. At present, sawn fuel-wood is preferred to chopped wood by most lorry operators. In general, drying is achieved most efficiently using wire silos, but in some cases other arrangements, such as storage on a wire-mesh floor, will also give satisfactory results. The booklet includes a short specification for fuelwood for use in mobile producers.

33.38.2 : 33.92. Gasholzsilos der Firme Locher & Co., Zürich. **[Producer-wood silos made by Locher & Co., Zurich.]** *Schweiz. Z. Forstw.* 92, 1941 (16–7). [G.]

The silos are cylindrical in shape and have removable roofs. They are 3·3 m. high and take about 24 stacked cu. m. of wood. The walls consist of wooden laths of 5 × 5 cm. section spaced at intervals of 4 cm. The floor is a wooden grate with concrete supports. The silos are filled and emptied using 3 doors arranged at different heights on their circumference.

33.38.3. USIO, I'. **Activated carbon.** *German Patent* No. 704,292, Feb. 27, 1941 (Cl. 12*i*. 33). Chem. Abs. 36 (1170). P.R.

Carbonized wood, sawdust, coconut shells, or the like, is ground to the desired size treated with water or steam, and heated to over 400°. The treatment is repeated until the desired degree of activation is attained.

33.39. Manufacture of Sugar, Oils, Alcohol, and Vinegar from Wood

33.39. ANT-WUORINEN, O. En ny metod att försockra trä med svavelsyrlighet. **[A new method of saccharifying wood with sulphur dioxide solution.]** *Svensk PappTidn.* 45, 1942 (149–57). [Sw.g.e.] P.O.

An account is given of the author's process for saccharifying wood by means of dilute SO_2 solutions. Results obtained at the experimental mill at Uleåborg, Finland, show that the lignin produced will supply the fuel requirements for the process when alcohol is the final product. The alcohol yield amounts to 60 litres per cu. m. of stacked wood.

33.39 : 34.6. KATSEN, R., and OTHMER, D. F. **Wood hydrolysis: a continuous process.** *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (314–22). [Polytechnic Institute, Brooklyn, N.Y.] L.S.

The subject of wood hydrolysis is reviewed. The new continuous process for the hydrolysis of wood and other plant fibres with dilute acid is described. It produces lignin and lignocellulose for plastics, as well as acetic and formic acids, furfural, and wood sugars. The process eliminates to a great extent the major problems encountered in batch processes and is applicable to wood flour, sawdust, or small chips. Advantages of the process include accelerated hydrolysis, better control of operating variables, and low steam, equipment, and operating costs. *From authors' summary.*

33.39 : 34.6. OTHMER, D. F., GAMER, C. H., and JACOBS, J. J. **Oxalic acid from sawdust: optimum conditions for manufacture.** *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (262–7). [Polytechnic Institute, Brooklyn, N.Y.] L.S.

33.39 : 34.6. OTHMER, D. F., and ROYER, R. H. **Oxalic acid from sawdust: recovery of products resulting from treatment of wood with caustic.** *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (274–9). [Polytechnic Institute, Brooklyn, N.Y.] L.S.

33.39 : 34.6. OTHMER, D. F., JACOBS, J. J., and PABST, A. C. **Oxalic acid from sawdust: continuous fusion process.** *Industr. Engng. Chem.* (*Industr. Ed.*) 34, 1942 (268–73). [Polytechnic Institute, Brooklyn, N.Y.] L.S.

Three papers dealing with processes and plant for the production of methanol and of oxalic, acetic, and formic acids by fusing sawdust with caustic soda. The yields obtained are possibly high enough to justify the use of the continuous fusion process on an industrial scale.

33.39 : 34.6. ROBERT, F. B. **Sugar and alcohol from wood waste.** *Timberman* 43 (8), 1941–42 (16, 65).

Includes a discussion of the advantages that may be expected from setting up a wood-sugar industry in the U.S.A. One of these would be the utilization of large quantities of wood waste.

33.4. *Converted Structural Timber*

33.4 : 12.25 : 38.2. LECLAIR, W. J. **Knotty White Pine panelling.** *Timber of Canada* 2 (9), 1941–42 (17–26).

Examples of the use of *Pinus strobus* panelling in interior decoration.

33.4 : 31.0 (94) : 33.91 : 31.27 : 38.2. THOMAS, A. J., and LANGLANDS, I. **Building-frames: timbers and sizes.** *Pamphl. Coun. sci. industr. Res. Aust.* No. 112, 1941. pp. 45. (*Tech. Pap. Div. For. Prod. Aust.* No. 36.)

A summary of information on the use of Australian timber for the construction of building frameworks. Detailed tables are included showing the most suitable sizes for various members of such structures.

33.5. *Pitprops, Sleepers, Poles and Other Roughly Converted Wood*

33.51 : 12.26–8 : 31.27. SIERRA LEONE. **Forestry report for the year 1941.** Govt. Printer, Freetown. 1942. pp. 12.

Compression tests with Mangrove pitprops show that they have qualities highly desirable for this use, being very strong for their size. Their only disadvantage is their weight, which might cause difficulties in handling under certain conditions (p. 7).

33.51 : 31.27 (68). BOWEN, J. W. **The suitability of supports used underground on the Witwatersrand.** *Repr.* from *J. S. Afr. Inst. Engrs.* Feb. 1941. pp. 24. P.R.

Different types of timber supports were investigated including those of Gum (mainly *Eucalyptus globulus*), Saligna (*Eucalyptus saligna*), and Wattle (*Acacia mollissima*). It is concluded that there is considerable scope for substituting poles and other types of timber supports for concrete supports now in use.

33.52 : 31.8 : 07.7. La consolidation par frettage des traverses en bois pour chemins de fer. **[Strengthening railway sleepers by means of iron hoops.]** *Gén. civ.* 119, 1942 (80–1). [F.] P.O.

Apparatus is described for the application of flat iron hoops to sleepers to prevent checking.

33.53 : 12.26–8 (51) : 33.91 : 31.27. LIMAYE, V. D. **Wooden poles for overhead electric transmission.** *Indian For. Leafl.* (*Utilization*) No. 8, 1941. pp. 3. [Forest Research Institute, Dehra Dun.] P.R.

This leaflet records in tabulated form the standard dimensions of wooden poles of different species groups for different heights by strength classes. *Author's summary.*

33.7. *Firewood*

33.7 : 31.24. DIOSZEGHY, D. **Heat value and combustion properties of wood.** *Technika* (*Budapest*) 22, 1941 (129–33). *Chem. Zbl.* 1942, I, 136. Fuel Res. Summ. 1942 (307). P.R.

The author has investigated the combustion of different varieties of wood. The sum of the free and fixed oxygen in the flue gas during the combustion of the volatile constituents was found to be nearly always higher than 20·9 per cent.

33.7 : 07.7. SCHLÄPFER, P., and STADLER, O. **Wood as fuel for central-heating installations.** *Bull. tech. Suisse romande* 66, 1940 (154–8, 161–5, 177–84); *Chem. Zbl.* 113, 1942, I, 2218. Fuel Res. Summ. 1942 (383). P.R.

Theory of combustion of wood. Dependence of calorific value on moisture content. Elementary composition and calorific value of species of wood. Carbonic-acid content and dew point of flue gases compared with those from coke. Central-heating installations designed for coke not directly suitable for wood. Descriptions of wood-fired central-heating plants in which the combustion gases are utilized for heating and cooking.

33.8. *Other Manufactured Products*

33.8. LECLAIR, W. F. La fabrication des violons. **[The manufacture of violins.]** *Timber of Canada* 2 (4), 1941–42 (54, 56, 58, 60, 62). [F.]

33.8 : 12.26–8 : 31.0. **Woods for Venetian blinds: Magnolia.** *Wood Products* 47 (6), 1942 (53–4).

Brief note on the range, tree characteristics, wood properties and uses, and production statistics of *Magnolia acuminata* in the United States.

33.8 : 12.25 : 31.0. ROTEN, F. Une canalisation originale en bois de mélèze. **[An original pipe-line of Larch wood.]** *J. for. suisse* 92, 1941 (170–3). [F.]

A 4-km.-long pipe-line of Larch wood has been used for over a century in conducting thermal water to the Ragaz bathing resort. Each length of pipe is composed of several staves. The water, which has a temperature of 37° C. at the source, undergoes a cooling of only 1·5–2° C. in the course of its journey.

33.9. *Grading and Storage of Converted Timber*

33.91 : 33.8 (73). **Cedar, Cypress, and Redwood tank-stock lumber.** *Commercial Standard CS* 92–41. National Bureau of Standards, Washington, D.C. 1941. pp. 11.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

34.2. *Vegetable Products*

34.2 : 12.26–8 : 31.0 : 21. El quillay. **[The Quillay tree.]** *La Chacra, Buenos Aires* 12 (133), 1941 (40). [Span.] *Trop. Woods* No. 70, 1942 (40).

Quillaja saponaria Mol. has foliage that is attractive to browsing animals, flowers that provide good bee pasturage, and much saponin in the bark, which is used locally for making soap and as the source of a medicinal and insecticidal extract. The wood is used for fuel and charcoal. Bark stripping during the hot, dry season usually results in the death of the trees, so that the accessible stands are being destroyed. The tree occurs in the foothills of the Andes in Argentina and Chile. It reproduces by seed, sprouts, and root suckers, and frequently forms small, nearly pure stands.

34.24. Tanning Materials. Cork

34.24. LEUENBERGER, G. À la recherche du tan perdu. **[In search of lost tannin.]** *J. for. suisse* 93, 1942 (43–4). [F.]

It is reported that in France Oak billets are now barked at all seasons using a simple steaming process perfected by Coldefy.

34.24 (51). Hsu, S. H., Chang, H. L., and Tien, Y. W. **A survey of common materials containing vegetable tannin found in Szechwan.** *J. Chem. Eng. China* 7, 1940 (26–8). [E.] Chem. Abs. 36 (2438). P.R.

34.24 (54). Narayanamurti, D., Pande, J. N., and Roy, D. C. **Note on some experiments on cork substitutes.** *Indian For. Leafl.* (*Utilisation*) No. 6, 1941. pp. 4 + fig. [Forest Research Institute, Dehra Dun.] P.R.

The experiments so far carried out have shown that suitable substitutes for cork in the following uses can be produced:—(i) Bottle stoppers—*Cryptomeria japonica* wood suitably slotted and softened by chemical treatment. (ii) Crown cork liners—composite cork made from *Erythrina suberosa* bark and bagasse fibre. (iii) Corks for hypodermic injection tabloid tubes—paraffin impregnated sola pith. The methods of manufacture are briefly described. *From authors' summary.*

34.24 (91.4). Alejo, L. G., Baens, L., and Lava, V. G. **The influence of hydrogen-ion concentration on the fixation of some Philippine vegetable tanning extracts by hide powder.** *Philipp. J. Sci.* 76, 1941–42 (1–15). [Bureau of Science, Manila.] L.S.

Philippine and imported Black Wattle (*Acacia decurrens*) and Anabiong (*Trema orientalis*), being poor diffusers and good fixers, may be used for light leather tanning and for the final stage in union tanning. Kamachile (*Pithecolobium dulce*) and Bakauan (*Rhizophora candelaria*), being poor fixers and diffusers, should be suitable for union tanning. Bitaog (*Calophyllum inophyllum*) is similar in diffusion to Quebracho (*Quebrachia lorentzii*) but is less astringent. Kalumpit (*Terminalia edulis*) and Myrobalan (*T. chebula*), being good diffusers and poor fixers, should be suitable only for preliminary tanning. Of the Philippine materials studied, Betel nut (*Areca catechu*) and Anabiong appear to have good commercial prospects. The former is an excellent diffuser and good fixer, and is suitable for all kinds of leather. Anabiong is abundant in abandoned clearings and second-growth forests, and has bark that is readily stripped.

34.24 : 12.25 : 12.11 : 12.14.8. Huber, B. Physiologische Untersuchungen zur Frage der Schälbarkeit der Fichtenrinde. [**Physiological investigations on the ease of stripping of Spruce bark.**] *Ber. dtsch. bot. Ges.* 58, 1941 (524–6). [G.] R.M.I.

In a study of Spruce at various elevations in the Erzgebirge the stripping period, i.e. the period when the bark is least resistant to stripping, began practically simultaneously at all elevations in mid-May and lasted, with an interruption in the second half of July, until about mid-August. Stems felled before the stripping period could be barked at the usual time, provided that they had not dried out excessively. It was concluded, and confirmed by girdling experiments, that the stripping period is connected with the recession of the sap stream from the crown downwards. Below the girdling point the stripping period was suppressed, but above it was prolonged into the autumn. The author's supposition is that the stripping period depends upon local softening of the cambium walls by growth substances, and that the type of cambial growth and the water content do not play a major part.

34.24 : 12.26–8 (81). **Cork manufacturers may use Brazilian raw material.** *Industr. Ref. Serv. U.S. Dep. Comm.* Pt. 4.—*For. Prod.* No. 8, 1941. p. 1.

Brazil may prove a valuable source of raw material for the American cork industry. It is reported that there is found in Brazil a type of bark which, when ground, has the appearance of cork and is being used for insulating purposes. It appears that there are four or five different trees, all of the same family, from which this bark is produced; the best known are the Pau Santo (Angico Rayado) found in the State of Minas Geraes and the Pau de Gordinko found in the State of Matto Grosso. Estimates vary as to the amount of this raw material which could be assembled for export, but the latest report states that 'exportable quantities of the bark would be available to the extent of some millions of tons depending upon the buyers' demand and prices'. At present this bark is purchased by the only two cork factories in Brazil to the extent of about 4,000 tons per annum each. Larger purchases of this bark in the interior would have to be financed and organized by another company, since present operators are not prepared to invest additional capital in this activity. [Cf. *For. Abs.* 3 (331).]

34.24 : 12.26–8 : 34.26 : 34.27. Rogers, J. S., and Beebe, C. W. **Leaching and tanning experiments with Tara pods.** *J. Amer. Leather Chem. Ass.* 36, 1941 (525–39). [Bureau of Agricultural Chemistry & Engineering.] L.S.

Tara pods are derived from *Caesalpinia spinosa* (Mol.) Ktze. (*C. tinctoria* (H.B.K.) Taub., *C. pectinata* Cav.), a shrub or small tree of tropical America. Preliminary studies of tanning preparations made from them indicate that they can be used as a substitute for Sicilian Sumac. In further studies, it is intended to investigate the possibilities of gum from the pods as a by-product, since it appears to be similar to other gums that have commercial value.

34.25. Medicinal Plants

34.25 : 12.26–8. LaForge, F. B., Haller, H. L., and Sullivan, W. N. **The presence of an insecticidal principle in the bark of Southern Prickly Ash.** *J. Amer. chem. Soc.* 64, 1942 (187). [Bureau of Entomology & Plant Quarantine, U.S.D.A.] L.S.

A petroleum ether extract of bark of *Zanthoxylum clavaherculis* L. was found to contain, besides asarinin, a substance highly toxic to houseflies. The specific constituent has not yet been isolated in pure form.

34.25 : 12.26–8 : 34.27. Hörmann, B. Die Sanddornbeere (*Hippophaë rhamnoides* L. [**Sea Buckthorn (*Hippophaë rhamnoides* L.).**] Schriftenreihe: Heil- und Nährkräfte aus Wald und Flur. Verlag der Pflanzenwerke, München. [1941?]. pp. 26. [G.] *Abstr.* in *Allg. Forst- u. Jagdztg.* 118, 1942 (135–6). [G.]

A monographic study. According to the author the berry of Sea Buckthorn is the best source of vitamin C so far known; household conserves of this berry, if properly prepared, preserve their vitamin content almost unimpaired throughout the winter.

34.26. Resin. Turpentine. Oils. Gums. Rubber. Gutta Percha

34.26. Tisdale, H. R. **Natural dyewoods and their present position in defense economy.** *Chem. Ind., N.Y.* 49, 1941 (784–6). [American Dyewood Co.] L.S.

A brief review is made of the sources and uses of Logwood (*Haematoxylon campechianum*), Fustic (*Chlorophora tinctoria* Gaud.), Hypernic (*Caesalpinia*

spp.), Osage Orange (*Maclura pomifera*), Quercitron bark (*Quercus velutina*), Cutch (*Acacia catechu*), and Gambier (*Uncaria gambir*). These natural dyes are likely to assume importance whenever there are shortages of synthetic dyestuffs and may therefore be in demand during the present emergency.

34.26 (67.6 : 67.8 : 68.9). GREENWAY, P. J. **Wild rubber in East Africa.** *E. Afr. agric. J.* 7, 1941–42 (224–7). [E. African Agricultural Research Station, Amani.]

Notes on *Clitandra orientalis*, *Funtumia elastica*, *Landolphia* spp., *Mascarenhasia elastica*, and *Holarrhena microterantha*, with analytical data on the rubbers of most of the species. Wild rubber is likely to play its part under war-time conditions, but its exploitation may be hindered by the reduction in vegetational communities in which the plants occur and by the difficulty of attracting African labour to the work.

34.26 (75 : 76). INESON, F. A., and RAYL, E. M. **Gum naval stores productivity zones.** *Sth. For. Notes* No. 42, 1941 (2–3).

Zones of varying productivity in the southern United States are indicated by a sketch map.

34.26 : 12.25. BEILER, A. Untersuchungen über die Lebendharzung der Kiefer. **[Investigations on the tapping of Pine for resin.]** *Forstwiss. Cbl.* 63, 1941 (217–31). [G.g.]

In the investigations described the total amount of resin flow varied from tree to tree even in the first ten minutes of tapping, and different trees gave different rate-of-flow curves in the first few hours of tapping. The resin was drained from the stem up to a height of several metres above the position of a blaze, as was indicated by the discharge curves of blazes arranged at different heights above blazes from which resin had been tapped earlier in the day.

34.26 : 12.25. BOMBERGER, E. H., and BAKER, L. F. **Oil extraction from Texas 'Cedar'.** *Sth. For. Notes* No. 41, 1941 (2–3).

Note on the extraction of oil from both wood and leaves of Mexican Juniper (*Juniperus mexicana*) by a steam-distillation process. By-products include a waxy substance known as cedrol from the wood oil and camphor from the leaf oil.

34.26 : 12.25. LIEFELD, T. A. **Chemical treatment of streaks continues to show promise.** *Sth. For. Notes* No. 40, 1941 (2–3).

Cf. *For. Abs.* 3 (154). Preliminary results from a further experiment showed an increased resin yield from Slash Pine in response to all six acid treatments tested while Longleaf Pine gave no significant positive response to any of the treatments.

34.26 : 12.25. LIEFELD, T. A. **Relation of naval stores yields to frequency of chipping.** *J. agric. Res.* 64, 1942 (81–92). [Southern Forest Exp. Sta.] O.R.E.

In this study of the effects of different chipping frequencies on yields of resin from Longleaf Pine, three treatments were applied, approximating customary seasonal chipping practice, moderate year-round practice, and heavy year-round practice. Resin yield per 24 hours and total yield per streak were recorded for approximately 4 years from two 10-tree groups in each treatment, together with the maximum air temperature on the days of chipping. From the data obtained it was established that neither moderate nor heavy year-round chipping causes excessive drain on the vitality of the trees, and that frequent chipping is advantageous when rapid exploitation and high annual or seasonal production are desired. Chipping frequencies, however, should not exceed three times a week in summer or every other week in winter. Where long working life of the same faces or trees is more important than high production per year, a schedule of semi-weekly chipping in summer, weekly in spring and autumn, and semi-monthly in winter is indicated. Even in conservative work, however, loss of resin yield would result from chipping less often than every 2 weeks in summer and every 6–8 weeks in winter. If varying intervals between chippings is impracticable, the results would indicate the desirability of weekly chipping from March to November and fortnightly chipping in winter, or, for longer working life, a rigid schedule of fortnightly chipping throughout the year.

34.26 : 12.25 (46). RUIZ-ZORRILLA, A. C. La resinación del *Pinus pinaster* en los montes de las llanuras de Castilla. **[Management of *Pinus pinaster* for resin in the forests of the Castilian plains.]** Instituto Forestal de Investigaciones y Experiencias, Madrid. 12 (18), 1941. pp. 143. [Span.]

A monograph dealing with the botany and silviculture of this species, its exploitation for resin in Castile, and with relevant economic and legal questions.

34.26 : 12.25 : 34.25. GHOSE, T. P., and VARMA, B. S. **Medicinal products from *Pinus longifolia* tar.** *Indian For. Leafl.* (*Chemistry*) No. 12, 1942. pp. 6. [Forest Research Institute, Dehra Dun.] P.R.

The tar from *Pinus longifolia* stump wood has been shown to be a reasonably rich source of certain medicinal products such as Pix liquida B.P., Oleum picis B.P., Spirit of tar, Rectified oil of tar and Creosotum B.P. Chir creosote is poorer in guaiacol content compared to Beech wood creosote, but the guaiacol and creosol fractions combined have been found in sufficient quantity in the former to make it a profitable source of medicinal wood creosotes. *From authors' summary.*

34.26 : 12.26–8. WALKER, G. **Notes on *Leptospermum citratum*.** *E. Afr. agric. J.* 7, 1941–42 (202–3).

Notes on plantation management of *L. citratum* in Kenya. Since the war, prices have risen, and oil is regularly being exported from the plantations in question. [Cf. *For. Abs.* 4 (50–1).]

34.26 : 12.26–8 : 34.25 : 34.27. GODBOLE, N. N., GUNDE, B. G., and SRIVASTAVA, P. D. **The seed fat of *Buchanania latifolia*.** *J. Indian chem. Soc.* 18, 1941 (557–62). [Dept. of Industrial Chemistry, Benares Hindu University.] L.S.

Seeds of *B. latifolia* are commonly used in India for confectionery, and their oil as a substitute for almond oil in medicinal uses. Both seed and oil are recommended by Indian physicians for curing certain skin diseases. Analysis of the seed fat gave the following fatty-acid contents in percentage by weight:—palmitic 29, stearic 8, oleic 57, and linoleic 6. The fat contains 4·8 per cent. of fully saturated glycerides.

34.26 : 12.26–8 : 34.27. BAUER, K. H., and MOLL, H. Über die Inhaltsstoffe der Shea-Nüsse, der Samen von *Butyrospermum parkii*. **[On the constituents of Shea nuts, the seeds of *Butyrospermum parkii*.]** *Arch. Pharmaz. Ber. dtsch. pharmaz. Ges.* 19, 1942 (37–45). *Fette u. Seifen* 49, 1942 (137). [G.] P.O.

34.26 : 12.26–8 : 34.27. CHILD, R., and NATHANAEL, W. R. N. **The seed fat of *Litsea longifolia* Bth. & Hk.** *J. Amer. chem. Soc.* 64, 1942 (1079–81). [Coconut Research Scheme, Bandirippuwa Estate, Lunuwila, Ceylon.] L.S.

Kernels of *L. longifolia* gave a crude-fat yield of 29 per cent., based on dry weight. The fatty-acid content of the fat was lauric 81·9, palmitic 3·1, stearic 2·2, and oleic acid 5·5 per cent. There was 7·2 per cent. of unsaponifiable matter. The component glycerides contained at least 80 per cent. of trilaurin. The fat has little economic value, owing to the comparatively low yield of the kernels and the high percentage of unsaponifiable matter.

34.27. Seeds. Fruits. Leaf Fodder

34.27. MOLINA GARCES, C. Arboles, arbustos y pastos forrajeros. **[Forage trees, shrubs, and pastures.]** *Tierras y Aguas, Bogotá* 3 (17; 18), 1940 (8–30; 8–13). [Span.] *Trop. Woods* No. 70, 1942 (38–9).

Includes descriptive accounts of several tree species, mostly Leguminosae, whose leaves and fruits are used for fodder.

34.27 : 12.26–8 (68). BONSMA, J. C. **Useful bushveld trees and shrubs. Their value to the stock farmer.** *Fmg. S. Afr.* 17, 1942 (226–39, 259). [Division of Animal & Crop Production, Union of South Africa.] L.S.

Brief notes are given on the forage value, distribution, wood, and general characters of *Copaifera mopane*, *Capparis albitrunca*, *Combretum apiculatum*, *Grewia flava*, and *Acacia spirocarpoides* (*A. litakunensis*). Tables are included to show the crude protein, crude fibre, P_2O_5 and CaO contents of the first four species for each month of the year. Compared with grass, the bushveld shrubs and trees vary but slightly in protein and phosphorus content through the seasons. These trees have an important place in cattle nutrition, particularly during drought periods, and a protest is made against their clearance for firewood.

34.29. Grass for Paper-making

34.29 : 12.29 : 33.32. BHARGAVA, M. P., and SINGH, C. **Wrapping and packing papers from *ulla* grass (*Themeda arundinacea*, Ridley, Syn. *Anthistiria gigantea* Cav.).** *Indian For. Bull.* (*n.s.*) *Utilisation* No. 100, [1941] 1942. pp. 13 + samples. [Forest Research Institute, Dehra Dun.]

34.6. *Utilization of Logging and Milling Waste*

34.6–: 33.32. FREY, U. **Material suitable for floors or walls.** *British Patent* No. 521,404, May 21, 1940. Chem. Abs. 36 (881). P.R.

The material is made by paraffining wood waste and kneading it together in the presence of a casein-glue solution.

34.6 : 33.32. GOLDFINGER, A., and FREED, E. **Building material.** *British Patent* No. 536,477, May 15, 1941. Chem. Abs. 36 (1752). P.R.

Wood dust, with or without admixture of wood shavings, is treated with lime and water and mixed with a substantially equal part by weight of cement and with sufficient water containing about 2–3 per cent. by weight of a soluble metallic silicate. A small proportion of phenol, not exceeding 1 per cent. by weight, is then added to the mixture, which is subjected to a moulding operation under pressure.

34.6 : 33.39 : 11.47.12. GAHLNBÄCK, J. Eignen sich Holzabfälle als Ersatz für Torfmull? **[Is wood waste suitable as a substitute for peat mould?]** *Bodenk. PflErnähr.* 27, 1942 (368–70). [G.] H.S.B.

The residue obtained in the Scholler-Tornesch process of wood saccharification, consisting mainly of raw lignin, was shown by chemical analyses and manurial trials to be unsuitable as a substitute for peat mould.

34.6 : 34.26 : 33.32. MARTIN, R. W. (to Hercules Powder Co.) **Resinous compositions suitable for molding and bonding.** *U.S. Patent* No. 2,265,181, Dec. 9, 1941. Chem. Abs. 36 (1697). P.R.

A ligneous material such as Pine-stump chips and a rosin acid are heated, with sufficient water to effect substantially complete submersion of the wood, under superatmospheric pressure at about 240–330° until the cellular structure of the wood is destroyed, and a resin is recovered as a residue after removal of the aqueous solution.

38. FOREST CONSTRUCTIONAL WORKS. ENGINEERING

38.2. KEITH, L. P. **Modern timber connector construction.** *Sth. Lumberm.* 165 (2070), 1942 (55–6).

38.2 : 31.27. **Timber of Canada Design Data Sheet: Working stresses. [Safe allowable stresses for structural timber.]** *Timber of Canada* 2 (3; 4), 1941–42 (23–4; 29–30). *File* 11–1c.

38.2 : 31.27. **Timber of Canada Design Data Sheet: Working stresses. [Allowable clear spans for rafters.]** *Timber of Canada* 2 (7), 1941–42 (39–40). *File* 11–3b.

38.2 : 31.27. **Timber of Canada Design Data Sheet: Working stresses. [Allowable clear spans for floor joists.]** *Timber of Canada* 2 (5), 1941–42 (25–6). *File* 11–3.

38.2 : 31.27. **Timber of Canada Design Data Sheet: Working stresses. [Allowable clear spans for ceiling joists.]** *Timber of Canada* 2 (6), 1941–42 (31–2). *File* 11–3a.

38.2 : 33.15. BJÖRKMAN, A. Träkonstruktioner 'system Töreboda'. **[Töreboda-system timber construction.]** *Tekn. Tidskr.* 72 (Sec. E.), 1942 (69–74). [Sw.] P.O.

A general, illustrated account is given of Töreboda timber construction, in which glued, laminated beams, arches, and other framing are employed.

38.2 : 33.4 : 33.91. **British Standard Specification: The use of timber in building construction. Pt. I. Floors of ordinary board and joist construction.** *British Standard* No. 1018, 1942. pp. 12. P.R.

38.2 : 38.3. HOLTMAN, D. F. **Heavy timber construction: bridges and trestles.** *Timber of Canada* 2 (2), 1941–42 (27–34). [National Committee on Wood Utilization.]

Annotated examples of design.

38.62. ALDOUS, W. M. **Airport drainage.** *Timber of Canada* 2 (5), 1941–42 (19–23). [Civil Aeronautics Administration, Washington, D.C.]

Notes on drains made of creosoted wood and used in the drainage of airports.

4. FOREST INJURIES AND PROTECTION

41. GENERAL PROTECTION AGAINST FOREST INJURIES

41 : 24.5. YORK, H. H. **Tree-wound dressings.** *Shade Tree* 14 (10), 1941 (1–3). [University of Pennsylvania.]

A brief review of the essential properties and chief types of dressings.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.2. *Temperature Influences*

42.21 : 23.27. YOUNG, F. D. **Frost and the prevention of frost damage.** *Fmrs' Bull. U.S. Dep. Agric.* No. 1588, (revised ed.) 1940. pp. 65. [U.S. Weather Bureau.]

With particular reference to horticulture. A simple explanation of the changes that take place at or near the earth's surface on a frosty night is followed by a detailed discussion of the various methods and devices now being used for protection against frost. One chapter deals with temperatures injurious to plants, blossoms, and fruit.

42.23 : 12.25 : 21.1. ROLLER, J. H. **Effect of heat and light on Red Spruce.** *Castanea* 7, 1942 (49–50).

The death of young trees of *Picea rubens* on White Top Mountain, southwestern Virginia, after exposure by a group cutting of the larger trees, is attributed to the effects of heat and light, to which this species seems more susceptible than any other of the region. The bark first dies on the south exposure to the height of the former shading and the tree lingers for 2–3 years and then dies owing to the inability of the live bark and sapwood on the northern side to supply its food requirements. The original blank has been growing in size by the successive death of the bordering trees, but this is expected to cease when the regeneration becomes tall enough to restore shade.

42.3. *Precipitations*

42.32 : 12.25 : 44.3. FABRICIUS, L. Gefährdet Gipfelbruch in Fichtenbeständen die Gesundheit des Stammholzes? **[Does top breakage in Spruce stands endanger the soundness of the stem wood?]** *Forstwiss. Cbl.* 63, 1941 (255–60). [G.]

Investigations on 61 trees the tops of which had broken as the result of snow pressure 18 years earlier showed that, on an average, discoloration had affected the upper third of the stem of the (remaining) crown. The greater the diameter of the stem at the point of breakage, the greater was the length of stem affected. The author suggests that if only one-fifth or less of the crown of a tree is left after a breakage has occurred, the tree should be felled at once. Otherwise it may be left growing for some years without endangering the soundness of the more valuable timber in the lower part of the tree.

42 5. *Chemical Influences*

42.5 : 12.25 : 11.47.13. AUSTRALIA. **Fifteenth annual report of the Council for Scientific and Industrial Research, for year 1940–41.** Govt. Printer, Canberra. 1941. pp. 107.

Increased diameter growth in backward Pine stands and high percentage recovery from 'needle-fusion' occurred during the second season following the broadcast application of top-dressings of superphosphate at 1½–3 cwt. per acre. Water-culture experiments showed that boron is essential to the normal growth of seedlings of *Pinus radiata* and *P. taeda* (pp. 16–7).

42.5 : 12.26–8 : 34.27. BRAUCHER, O. L., and SOUTHWICK, R. W. **Correction of manganese-deficiency symptoms of Walnut trees.** *Proc. Amer. Soc. hort. Sci.* 39, 1941 (133–6). [University of California, Riverside.] E.M.B.

Manganese deficiency in trees of *Juglans regia*, manifested by mottling and, in severe cases, burning and premature shedding of the leaves, has been corrected on an experimental scale by applying manganese salts as injections or sprays. Dry salt injections into holes bored into the wood produced a marked response in the following season if made during the summer or winter months, and early summer injections sometimes gave responses in the same season. Good results were obtained in limbs 4–6 in. in diameter by injecting manganese sulphate into 4 holes at the rate of 5 g. per hole. Holes should be staggered and not less than 4 in. apart. Injection of dry salts was not usually followed by severe bark injury, though some wood injury occurred. The best responses to sprays of manganese sulphate resulted from applications in late May and June. Concentrations exceeding 20 lb. per 100 gal. caused leaf burn. Liquid injections and soil treatments are also under trial.

43. FOREST FIRES

43 : 02.1 (78 : 79). **Fireman's guide. Region 1. U.S. Forest Service** [Region 1, Missoula, Mont.?] 1940. pp. 291.

A handbook of instruction for the conduct of fire-control work in this region.

43 (73) : 07.2 : 09.1. GISBORNE, H. T. **Review of problems and accomplishments in fire control and fire research.** *Fire Control Notes* 6, 1942 (47–63). [Nth. Rocky Mt. Forest & Range Exp. Sta.]

A brief historical review of progress in the U.S.A. since 1904.

43 (79.4) : 07.2. BUCK, C. C., BRUCE, H. D., ABELL, C. A., and FONS, W. L. **A forest fire protection problem analysis for California.** California Forest and Range Experiment Station, Berkeley. 1941. pp. 143.

In this paper an attempt is made to analyse the problems of forest-fire control that confront the several protection agencies of California. For this analysis some 370 questions were propounded, all important but none satisfactorily answered. These questions were combined into 77 generalized problems covering the entire field of fire protection. Of these, 32 problems were judged of high importance rank. Eight of these are being investigated at present by the Experiment Station. *From authors' summary.*

43.0. *Predisposing Factors and Causes*

43.0. HAYES, G. L. **Differences in fire danger with altitude, aspect, and time of day.** *J. For.* 40, 1942 (318–23). [Northern Rocky Mt. Forest & Range Exp. Sta.]

From tests undertaken in the northern Rocky Mountain region forest-fire behaviour ratings have been developed for different altitudes, different hours of the

day and night, and on south and north slopes for the most common type of day occurring in August. Charts show the hazard rating for different conditions, 'contour lines' representing the altitude and time of day of occurrence of certain classes of 'fire behaviour' as rated by a standard fire-danger meter. The application of this information is discussed.

43.0. Morris, W. G. **Gaging fire weather in the woods.** *W. Cst. Lumberm.* 69 (6), 1942 (18, 20, 67). [Pacific Northwest Forest & Range Exp. Sta.]

The four principal weather factors that affect forest fire hazard are precipitation, relative humidity, temperature, and wind. Brief notes are given on the technique and instruments used for measuring each of these factors and on their effect on fuel inflammability and fire spread.

43.1. *Protective Measures*

43.1 (79.7). Matthews, D. N., and Morris, W. G. **Forest fire control in western Snohomish County, Washington.** Pacific Northwest Forest & Range Exp. Sta., Portland, Ore. 1940. pp. 77.

From an analysis of the regional fire control problem, specifications and cost estimates are drawn up for what is considered an adequate fire-control organization.

43.1 : 81 : 07.7. Lawson, H. K. **Random news notes from the Forest Service Radio Laboratory.** *Fire Control Notes* 6, 1942 (67–9). [Region 6, U.S. Forest Service.]

Notes on new equipment (transmitters, receivers, etc.) developed or tested at this laboratory.

43.1 : 81 : 7. MacQueen, I. C. **Economic planning of forest protection.** *For. Chron.* 18, 1942 (41). [British Columbia Forest Service.]

Note on survey, reclassification of forest areas and other steps taken to hold fire losses to a minimum in the Nelson Forest District of British Columbia.

43.13 : 07.7. **Fire fighter.** *Timberman* 43 (6), 1941–42 (62, 64).

Description of a compact, highly manoeuvreable, four-wheel trailer pump for use in woods or storage yards. It carries 500 ft. of hose, pumps 500 gal. per minute, and can support two 2½- or four 1½-in. hose lines.

43.13 : 07.7. Stewart, G. **A new type of fire equipment in Michigan.** *Fire Control Notes* 6, 1942 (70–80). [Roscommon Exp. Sta., Michigan Dept. of Conservation.]

Description of a unit consisting of a tank, power pump, tool box, and hose reel, the entire outfit being attached to a sled-like base. The unit may be transported by truck or trailer. The unit is 6½ ft. long, 30 in. wide, and 40 in. high. The tank capacity is 110 gallons. The discharge is about 5 gallons per minute, with a pressure range up to 300 lb. per sq. in. Power is provided by a 2-h.p. motor. With trailer and tractor the unit can be conveniently transported over rough country.

43.3. *Fire Damage*

43.3 : 12.25 : 56.02. Stone, E. L. **Effect of fire on radial growth of Longleaf Pine.** *Sth. For. Notes* No. 43, 1942 (3).

During the first year after fire the radial growth on surviving Longleaf Pine under 6 in. d.b.h. averaged 23 per cent. less than for trees on unburned areas, while for larger trees the decrease averaged 19 per cent. Normal growth is usually resumed by the second year after fire.

43.3 : 74. **Appraising forest fire damage in New Jersey.** *Occ. Pap. Allegh. For. Exp. Sta.* No. 4, 1941. pp. 8.

A method based on rough sample-plot surveys of burned areas is described. Plots are tallied by counting trees and estimating the average diameter. Damage estimates are computed using standard tree values.

44. Damage by Harmful Plants. Virus Diseases.

44.1. *Forest Weeds*

44.1 : 43.03. Heinrich, F. **Is the use of weed-combating agents containing chlorate of significance as a forest-fire danger?** *Forstarchiv* 16, 1940 (189–94). Chem. Abs. 36 (2145–6). P.R.

Experiments with $NaClO_3$ and Anforstan, a commercial product containing $NaClO_3$, showed that there was little risk of spontaneous combustion unless the temperature was much higher than would be expected from solar radiation and the proportion of $NaClO_3$ to organic matter was greater than customarily used. Ignition temperatures for 1 : 1 mixtures of dried weeds or other dried forest litter with $NaClO_3$ varied from 115° to 180°, and with Anforstan was more than 220°. A spark of 12- to 28-second duration was required to ignite mixtures with $NaClO_3$, while a 30-second spark still caused no combustion with Anforstan.

44.2. *Parasitic Higher Plants*

44.2 : 12.25 : 12.26–8. Pomerleau, R. Le gui de l'épinette noire dans le Québec. **[The mistletoe of Black Spruce in Quebec.]** *Nat. canad.* 69, 1942 (11–31). [F.f.] [Ministère des Terres et Forêts, Québec.] L.S.

Chiefly an account of observations in Quebec on *Arceuthobium pusillum* Peck parasitic on *Picea mariana*. The large witches' brooms resulting from the infection do not appear to have any marked influence on the growth of the tree.

44.2 : 12.26–8 : 12.21. Darling, L. ***Protocoronospora* on *Phoradendron flavescens* in California.** *Madroño* 5, 1940–41 (241–6). [University of California.] K.

Description of *P. phoradendri* sp. nov., a new disease of *P. flavescens* (Pursh) Nutt. var. *macrophyllum* Engelm., a mistletoe parasitic on Willows and Poplars growing on the north-west shore of Clear Lake in Lake County, California. Both leaves and stem are attacked, usually leading to the death of the host.

44.3. *Fungi*

44.3. Dimond, A. E., Horsfall, J. G., Heuberger, J. W., and Stoddard, E. M. **Role of the dosage-response curve in the evaluation of fungicides.** *Bull. Conn. agric. Exp. Sta.* No. 451, 1941. pp. 635–67.

In the laboratory a fungicide is usually tested at a number of dosages and data obtained on the spore inhibition which these dosages effect. The dosage-response data may be usefully plotted on a logarithmic probability grid. The types of curve obtained and their interpretation are discussed with special reference to the co-ordination of laboratory and field tests.

44.3 : 12.21. Zerova, M. Ya. **Some *Phomopsis* species new for the U.S.S.R.** *Bot. Zh.* (*J. bot. Acad. Sci. RSS Ukraine*) 1 (2), 1940 (305–12). [Ukr. r. e.] K.

Twelve species are described, of which five are new to science:—*P. occulta* Trav. var. *ginkgoina* Grove on *Ginkgo biloba*; *P. diaporthes-macrostomae* Trav. on *Fagus sylvatica*; *P. glandicola* Grove on *Quercus*

polymorpha; *P. perniciosa* Grove on *Persica vulgaris*; *P. lumae* Syd. on *Myrtus communis*; *P. liriodendri* Grove on *Liriodendron tulipifera*; *P. cocculi* Maffei on *Cocculus laurifolia*; *P. lavitskii* Zerova sp. nov. on *Cissus anthactica*; *P. nerii* Zerova sp. nov. on *Nerium oleander*; *P. eucalypti* Zerova sp. nov. on *Eucalyptus* sp.; *P. perseae* Zerova sp. nov. on *Persea gratissima*; and *P. diospyri* Zerova sp. nov. on *Diospyros lotus*. All the *Phomopsis* species were discovered in hot-houses or on acclimatized plants. In most cases the plants attacked perished as a result of the infection. The writer believes that *P. cocculi* Maffei and *P. nerii* Zerova sp. nov. are identical with *P. anamirthae* F. Tassi and *P. nerii* Speg., respectively.

44.3 : 12.25 : 12.21. BINGHAM, R. T. **Secondary fungi associated with White Pine blister rust cankers.** *Abstr.* in *Nthwest. Sci.* 16, 1942 (39). [University of Idaho.] A.P.B.

Of these secondary fungi the most important, in regard to both frequency and distribution, are *Tympanis hypopodia* Nyl. and a *Dasyscypha* tentatively identified as *D. calyciformis* (Willd.) Rehm. The secondary fungi exert some measure of biological control over the blister-rust disease; very little control is effected where White Pines are already infected by the latter, but the action of secondary fungi probably makes for considerable reduction in the spread of blister rust by diminishing aecial sporulation.

44.3 : 12.25 : 12.21. BJÖRKMAN, E. Renkulturförsök med snöskytte svampen (*Phacidium infestans* Karst.). **[Pure culture experiments with the snow-blight fungus (*Phacidium infestans* Karst.).]** *Svensk bot. Tidskr.* 36, 1942 (108–23). [Sw.g.] L.S.

In the spring of 1940 specimens were taken of Pine needles infected with *P. infestans* and also of the characteristic mycelia that appear to occur with fair regularity on such needles. From this material 4 fungi were isolated in culture: a white mycelium, a black mycelium, a *Penicillium*, and a grey-white mycelium that grew out from the interior of a needle fragment. In mid-October of the same year portions of all isolates except the *Penicillium* were transferred to sound 5-year-old Pine plants, being placed on the needles at an average height of 2 dm. above the soil level. In some cases portions of the cultures were also placed on the ground under sound Pine plants. Examination in the following spring showed that in 90 per cent. of the inoculated plants the needles had become brown-flecked around the grey-white mycelium, whereas the other two mycelia had failed to produce any similar effect. Even in cases where the mycelium had been laid on the ground under a plant a discoloration of the lowest needles was noted. During the autumn of 1941 it was established that the needles around the grey-white mycelium were infected with *P. infestans*. The greatest area of infection produced by an inoculation with the grey-white mycelium was 36 cm. in diameter, but the average diameter of the infection areas was only 18 cm. and the rapid-growing mycelia generally distributed in snow have probably nothing to do with *P. infestans*. From germinating spores a mycelium was isolated that appeared identical with the grey-white mycelium except for rather faster growth, and in culture these two mycelia sometimes formed clear anastomoses. Details are included on the behaviour of the fungi in culture.

44.3 : 12.25 : 12.21. PADY, S. M. **Further notes on the witches' brooms and the substomatal pycnia of *Melampsorella*.** *Trans. Kans. Acad. Sci.* 44, 1941 (190–201). [Ottawa University, Ottawa, Kansas.] N.H.M.

Further data in confirmation of the view that the *Melampsorella* on *Abies* and *Picea* are two distinct species.

44.3 : 12.25 : 12.21. STRONG, F. C. **Red Cedar rusts and their control.** *Trees, Sta. Monica, Calif.* 5 (2), 1942 (10–2). [Michigan State College.]

A brief account is given of the life histories and host relations of *Gymnosporangium juniperi-virginianae* and *G. globosum*, followed by recommended control measures. Neither of the rusts is likely to be serious if Red Cedars (*Juniperus* spp.) are located more than a mile away from Apples or Hawthorns, and screening by buildings, high shrubberies or non-susceptible trees may permit considerable reduction, to be determined by actual tests, of this distance. *Juniperus chinensis* and at least one strain of *J. virginiana* are immune. Immune and highly resistant Apples and Hawthorns are also listed, and a review is made of fungicides that have shown promise in spraying trials.

44.3 : 12.25 : 12.21. TUCKER, C. M., and MILBRATH, J. A. **Root rot of *Chamaecyparis* caused by a species of *Phytophthora*.** *Mycologia* 34, 1942 (94–103). R.A.M. 21 (276).

The name *Phytophthora lateris* is proposed for the fungus causing a serious root rot of *Chamaecyparis* [*Cupressus*] spp. in Oregon and Washington. The disease, which affects trees of all ages, first attacks the roots and thence spreads to the trunk and crown. The entire foliage undergoes complete discoloration within a period of 2–3 months in cool and damp, or 2–3 weeks in hot and dry weather. Eventually, the leaves wither and dry up and the tree is killed. The condition could easily be mistaken for transplanting injury but for the clear line of demarcation between necrotic and living tissues. Some blocks of nursery stock planted in infested soil were destroyed within 6 months; in other infested plantings trees continued to die over a period of 3–4 years. When infection occurs in old-established hedgerows, 3 or 4 trees die each year, the spread being more rapid if there is drainage down the row. All varieties of *C. lawsoniana* were found to be susceptible, some of *C. obtusa* were susceptible and others resistant, and all of *C. pisifera* showed resistance. A detailed description is given of the fungus in culture.

44.3 : 12.25 : 12.21 : 12.26–8. MIELKE, J. L. ***Ribes petiolare* Dougl. in California.** *Madroño* 6, 1941–42 (30–1). [Bureau of Plant Industry, U.S.D.A.] K.

This *Ribes* was first recorded in the region in 1918 near Lost Lake, southern Warner Mountains, Modoc National Forest. The writer reports that in this region dense concentrations of bushes grow in close association with *Pinus albicaulis* Engelm., but that blister rust has not been found so far on either the Pines or the currants.

44.3 : 12.25 : 12.21 : 13.2. HADDOW, W. R., and NEWMAN, F. S. **A disease of the Scots Pine caused by *Diplodia pinea* associated with the Pine spittle-bug.** *Repr.* from *Trans. R. Canad. Inst.* 24 (1), 1942. pp. 18 + plate. [Department of Lands & Forests, Ontario.]

In Ontario a disease known as *Diplodia pinea* blight of Scots Pine followed the invasion by that fungus of trees infested by the Pine spittle bug (*Aphrophora parallela*). The fungus and symptoms of *Diplodia*

pinea blight are described. The fungus was regularly isolated from the lesions characteristic of the disease. The injection of spores into terminal shoots of Scots Pine caused tip blight. Typical crown blight symptoms followed at length the application of spores to a spittle-bug-infested branch. *From authors' summary.*

44.3 : 12.25 : 12.21 : 21.3. STATE OF NEW YORK. **Conservation Department: thirty-first annual report, for the year 1941.** New York. 1942. pp. 402. *Legislative Document* (1942) No. 32.

Studies have shown that the root- and butt-rot caused by the fungus *Polyporus schweinitzii* and 'Resinosis', a disease of which the causal fungus is not identified, are mainly confined to areas with poor sub-soil drainage and relatively alkaline soil reaction (p. 110).

44.3 : 12.25 : 31.42.11. PATTEN, R. F. **Isolation of fungi associated with brown cubical heartrots of Western Redcedar.** *Abstr.* in *Nthwest. Sci.* 16, 1942 (38). [University of Idaho.] A.P.B.

Investigations are in progress at the Forest Pathology Laboratory, University of Idaho, on the continuous trunk rot and the pocket trunk rot of *Thuja plicata*. Of the large number of fungi isolated from rot specimens, three unidentified species are suspected as possible primary agents of decay. The occurrence of these in relation to the rot and to one another suggests that a synergic or metabiotic action may be involved.

44.3 : 12.26–8 : 12.21. DAVIDSON, R. W., CAMPBELL, W. A., and VAUGHN, D. B. **Fungi causing decay of living Oaks in the eastern United States and their cultural identification.** *Tech. Bull. U.S. Dep. Agric.* No. 785, 1942. pp. 65 + plates. [Bureau of Plant Industry, U.S.D.A.]

The more important fungi identified from Oak decay infections obtained from all areas sampled, beginning with those of most frequent occurrence, were *Stereum gausapatum, S. frustulosum, Hydnum erinaceus, Armillaria mellea, Fistulina hepatica* (on *Quercus coccinea*), *Poria andersonii, Polyporus compactus, P. dryophilus, Poria cocos, Polyporus sulphureus, Fomes geotropus, Corticium lividum* (on *Quercus lyrata* in the South), *Polyporus sprague*i, and *P. lucidus*. A key based on both macroscopic and microscopic characters in pure culture was arranged as an aid to identification, and detailed descriptions of the cultural characteristics of each species were made to serve as a basis for the isolation method of decay diagnosis.

44.3 : 12.26–8 : 12.21. FOSBERG, J. L. **New fungus disease caused by *Cytospora* threatens Chinese Elm trees of Colorado.** *Colorado Farm Bull.* 3 (3), 1941, (3–4).

Trees attacked by this disease fail to leaf, or produce small and sparse leaves. The disease is fatal. Infected trees should be removed and burned.

44.3 : 12.26–8 : 12.21. HOWARD, F. L. **Antidoting toxin of *Phytophthora cactorum* as a means of plant disease control.** *Science, N.Y.* 94, 1941 (345). [Rhode Island State College.] L.S.

The toxic effect of filtrates from cultures of *Phytophthora cactorum* can be antidoted by the addition to them of 0·5 per cent. aqueous solution of the di-hydrochloride salt of di-amino-azo-benzene plus a solvent and penetrant ('Helione orange'). Healthy Maple trees injected with the ordinary filtrate have died, whereas the antidoted filtrate failed to cause injury. Over 350 trees confirmed as naturally infected with the fungus have been injected with the antidote and have shown cessation of bleeding and marked improvement in growth, though it is not certain that a cure has been effected.

44.3 : 12.26–8 : 12.21. MOOK, P. V. **Canker-stain disease of Plane-trees.** *Trees Mag.* 4 (3), 1941 (7, 15–6, 18). E.S.R. 86 (803).

A general account is given of present knowledge of this disease of *Platanus occidentalis* and *P. acerifolia*, caused by *Endoconidiophora*.

44.3 : 12.26–8 : 12.21. PLAKIDAS, A. G. ***Venturia acerina*, the perfect stage of *Cladosporium humile*.** *Mycologia* 34, 1942 (27–37). R.A.M. 21 (274).

A leaf-spot disease of *Acer rubrum* observed near Ithaca, New York State and near Millinocket, Maine, in 1940, proved to be identical with that observed by J. J. Davis in Wisconsin in 1919 and attributed to *Cladosporium humile*. Perithecia of an ascigerous form of the fungus, for which the name *Venturia acerina* is proposed, were found on overwintered Maple leaves. Cultures from single asci or ascospores all yielded conidia identical with those of *C. humile*. The fungus was found to overwinter on the leaf either in the mycelial stage, producing conidia in spring, or in the perfect stage as perithecia. The fungus and the symptoms caused in the leaves are described in detail.

44.3 : 12.26–8 : 12.21 : 13.2. BUCHANAN, W. D. **Experiments with an ambrosia beetle, *Xylosandrus germanus* (Blfd.).** *J. econ. Ent.* 34, 1941 (367–9). R.A.E. A30 (180).

During attempts in 1940 to devise a laboratory method for infesting Elm wood with *X. germanus* it was observed that the beetles would enter the ends of unbarked wood but did not oviposit and seldom bored through the bark to the sapwood, and that when small areas of outer or both outer and inner bark were removed the beetles bored into the treated areas but did not oviposit and did not attack bruised or untreated portions.

On 1st July, strips of outer bark were removed from 13 Elm trees, and muslin cages, each containing 25 adults artificially contaminated with *Ceratostomella ulmi*, were attached to the trunks over both stripped and intact areas. By 4th September external symptoms of disease had developed in every tree, and *C. ulmi* was isolated from twigs in the crowns. As no injuries by *Hylurgopinus rufipes* or *Scolytus multistriatus* were observed and bands of colour extended up from the treated area in all trees examined, and as adjacent trees showed no symptoms, it is concluded that *X. germanus* had transmitted the disease. No oviposition occurred.

Larvae of *X. germanus* gave rise to adults after they had been fed for over a month on any one of the following fungi:—*C. ulmi* from Elm; *C. pluriannulata* taken from perithecia surrounding larvae in brood chambers in Red Pine; an unidentified fungus from a brood chamber in Elm; and a species of *Pestalozzia* separated from a mixture of fungi and bacteria in an agar plate over which an adult from Elm had crawled.

Injection of ethyl alcohol into living Elm trees was found to render them attractive to adults of *X. germanus*.

44.3 : 12.26–8 : 12.21 : 13.2. SMUCKER, S. J. ***Scolytus sulcatus* and Apple trees in relation to the Dutch Elm disease control program.** *Phytopathology* 32, 1942 (441–2). [Bureau of Plant Industry, U.S.D.A.]

Samples of apple wood infested with *Scolytus sulcatus* were collected at points within 1,000 ft. of Elms

infected with *Ceratostomella ulmi* but attempts to isolate *C. ulmi* from maternal galleries and beetles from the infested apple wood were unsuccessful. It is concluded that while *C. ulmi* is capable of remaining viable for long periods in living apple trees and in apple wood, the latter is not likely to be an important source of inoculum for later spread of the disease nor is the probability of *Scolytus sulcatus* transmitting the fungus to apple wood in nature an important factor at present in Dutch Elm disease control.

44.3 : 12.26–8 : 12.21 : 13.2 : 24.31. COLLINS, C. W. **Studies of Elm insects associated with Dutch Elm disease fungus.** *J. econ. Ent.* 34, 1941 (369–72). R.A.E. A30 (180–1).

An account is given of experiments made in New Jersey in 1935–40. The percentages of adult beetles infected with *Ceratostomella ulmi*, in collections of each of the four years respectively, were 6·9, 5·8, 7·7 and 5·71 for *Scolytus multistriatus*, and 4·3, 2·4, 3·3 and 0·7 for *Hylurgopinus rufipes*. The former is the most important vector of the fungus over the greater part of the area in which the disease occurs; the latter is also a fairly important vector, especially where the fungus has become established and *S. multistriatus* does not occur. Over-wintering adults of *H. rufipes* infect normal living Elms to only a limited extent, probably because they do not reach the newly formed spring vessels, but a higher proportion of infection is believed to be caused by beetles that mature from overwintered larvae and emerge after the spring vessels are functioning or after sap has begun to move in the trees.

Reference is also made to the experimental transmission of *C. ulmi* by *Scolytus sulcatus* and *Xylosandrus germanus* [cf. preceding abstracts and *For. Abs.* 2 (286); 3 (79)]: *Saperda tridentata* is also discussed. *C. ulmi* has been isolated from adults of the last-named that emerged from diseased Elm wood, and one contaminated adult has been taken in the field, but experiments have shown that it does not transmit the fungus effectively. Elm stumps left during eradication work are attractive to *S. tridentata*, ambrosia beetles, and some other species associated with the disease, and might act as reservoirs of the fungus. However, artificially contaminated adults of *S. tridentata*, caged on such stumps, gave adults that were cultured with negative results. As the females do not usually insert the eggs deeper than the inner bark, they are unlikely to cause an accumulation of the fungus in dead wood.

A spray of 4 parts by volume of water and 1 of orthodichlorobenzene, with an emulsifier, killed eggs, larvae, and pupae of both *S. multistriatus* and *H. rufipes*, and one of 4 parts of light fuel oil with 1 of orthodichlorobenzene, applied to freshly cut logs in May, repelled both species for the rest of the season, though untreated logs were heavily attacked. The most effective chemicals for killing Elm trees and preventing breeding by bark beetles were sodium arsenite at a dosage of 0·5 g. per in. diameter at breast height, copper chloride or copper nitrate (15 g.), ammonium bifluoride (30 g.) and copper sulphate or zinc chloride (60 g.), applied in water by means of a chisel-cut girdle and watertight collar.

44.3 : 23.27. GUBA, E. F. **Slime flux of shade trees.** *Trees, Sta. Monica, Calif.* 5 (2), 1942 (9). [Massachusetts State College Field Sta., Waltham, Mass.]

A brief note on treatment of bleeding trees under horticultural conditions.

44.3 : 23.27. RHOADS, A. S. **Growing new root systems by soil banking—a promising method of rejuvenating trees attacked by root diseases.** *Phytopathology* 32, 1942 (529–36).

Attention is called to the usefulness and practical value of a little-known natural method of inarching whereby trees and shrubs extensively girdled by root diseases may be rejuvenated by soil banking, either alone or in conjunction with previous surgical treatment, disinfection, and aeration, to stimulate the development of a new root system above the partially girdled bases. The results secured by the use of this method on Citrus trees and Australian Pines are described and illustrated and its applicability indicated for use on woody plants that develop adventitious roots readily. *From author's summary.*

45. DAMAGE BY ANIMALS

45. TOLUNAY, M. Eine neue wirksame Anwendungsmethode des Globols (Dichlorbenzol) gegen Insekten und Kleintiere. [**A new, effective method of using 'Globol' (dichlorobenzene) against insects and small animals.**] *Cbl. gesamte Forstw.* 68, 1942 (91–2). [G.]

In experiments at the Ankara School of Agriculture the evaporation of liquefied globol in a confined space killed various insects, mice, etc. contained therein within 24 hours. Ten g. of globol in 8–10 times the amount of boiling water were used per cu. m. of the space.

45.1. *Mammals*

45.11 : 43.1 : 11.62.11 : 91.1. DAMBACH, C. A. **Ten years of protection.** *Soil Conservation* 7, 1941–42 (252–3, 254, 256). [Soil Conservation Service.]

Abundance of reproduction of desirable species, improved soil conditions, and increase of insect-destroying birds followed the protection of a Maple wood from grazing. Volume of timber and maple-syrup yield are also believed to have been increased.

45.12 : 12.25 : 13.2. BALCH, R. E. **A note on squirrel damage to conifers.** *For. Chron.* 18, 1942 (42). [Dominion Entomological Laboratory, Fredericton, N.B.]

The red squirrel nips off shoots from various conifers and sometimes leaders and laterals from small trees to obtain the flower buds. The damage occurs usually in the late winter and spring. Under Canadian forest conditions the injury is not very serious.

45.12 : 12.25 : 13.2 : 23.1. KRAUCH, H. **Control of rodents in Douglas-Fir cut-over stands relatively more important than seed supply.** *Res. Note Sthwest. For. & Range Exp. Sta.* No. 100, 1942. pp. 2.

Best results from both natural regeneration and artificial seeding were obtained on areas where rodents had been controlled.

45.12 : 13.2. BARBEY, A. Dégâts par le 'campagnol amphibie' ou 'rat fouisseur'. [**Damage by the water rat, *Arvicola amphibius*.**] *J. for. suisse* 93, 1942 (39–41). [F.]

Description of damage on a 6-year-old Sycamore tree, on which *Corticium* had established itself as a saprophyte. The tree was completely dried out.

45.12 : 12.25 : 22.89. DAY, M. W. **Rabbits—a hazard to coniferous plantations.** *Quart. Bull. Mich. agric. Exp. Sta.* 24, 1942 (252–3). [Dunbar Forest Exp. Sta.]

Ordinarily rabbits do not frequent open fields, and damage to plantations is usually confined to areas

within 100 ft. of brush or timber cover. Damage by the snowshoe rabbit is particularly severe in areas adjacent to swamp. All conifers are damaged, but Pine seems to be preferred to Spruce and Fir.

45.3. *Insects*

45.3 (560). SCHIMITSCHEK, E. Beiträge zur Forstentomologie der Türkei IV. Die forstentomologischen Zonen der Türkei. **[Contributions to the forest entomology of Turkey. IV. The forest-entomological zones of Turkey.]** *Z. angew. Ent.* 28, 1941 (304–23). [G.] R.A.E. A30 (244).

Asiatic Turkey has extreme differences in climate and topography, with consequent variations in flora and fauna. The author recognizes 10 zones and briefly surveys the species of trees and insects found in the forests of each zone.

45.3 (71) : 05.3. CANADA. **Annual report of the Forest Insect Survey, Forest Insect Investigations, Division of Entomology, Science Service, 1941.** King's Printer, Ottawa. 1942. pp. 23.

During 1941 a total of 11,326 collections of forest insects was made throughout Canada. Notes are given on the occurrence and activity of the insects arranged under their respective host species. The most important insects of the year were the Spruce budworm (*Cacœcia fumiferana*) on Spruce, Balsam Fir and Larch and the variety of this Tortricid that attacks Jack Pine, the European Spruce sawfly (*Gilpinia hercyniæ*), the bronze Birch borer (*Agrilus anxius*), and the Larch sawfly (*Pristiphora erichsonii*).

45.3 (74.7). STATE OF NEW YORK. **Conservation Department: thirty-first annual report, for the year 1941.** New York. 1942, pp. 402. *Legislative Document* (1942) No. 32.

Forest insects in New York that showed a higher degree of infestation in 1941 than in previous years included the gipsy moth (*Porthetria dispar*), the European Pine shoot moth (*Rhyacionia buoliana*), and the Larch case bearer (*Coleophora laricella*). A generally satisfactory control of Le Contès sawfly (*Neodiprion lecontei*) was obtained by the application of 'Loomkill', a product obtained in the manufacture of talc, to clusters of feeding larvae (pp. 86–96). Of the important white grubs found in the Saratoga forest nursery, the species *Polyphylla variolosa* can be controlled by applying paradichlorobenzene in the soil at the time of ploughing, while for the species *Phyllophaga tristis*, *P. anxia*, and *P. fusca*, which fluctuate in abundance in regular cycles, it is recommended that a surplus production of one-year seedlings be made available in the years of known maximum abundance of the grubs (pp. 108–9).

45.3 : 07.2. GÄBLER, H. Die wichtigsten forstentomologischen Arbeiten aus den Jahren 1939–41. **[The most important papers on forest entomology during 1939–41.** *Thar. forstl. Jb.* 93, 1942 (202–18). [G.]

45.3 : 12.25 : 13.2. BALCH, R. E. **The Spruce sawfly outbreak in 1941.** *Pulp Paper Mag. Can.* 43, 1942 (385–8). [Dominion Entomological Laboratory, Fredericton, N.B.]

Report on the distribution and infestation of the Spruce sawfly (*Gilpinia hercyniae*) in eastern Canada during 1941, on the damage caused by this insect, and on the effect of control factors, including weather, disease, parasites, and mammal predators. It appears unlikely that outbreaks of the severity and extent of those occurring up to 1938 will be repeated.

45.3 : 12.25 : 13.2. POTTS, S. F., CLINE, A. C., and MCINTYRE, H. L. **The White Pine weevil and its control by the application of concentrated sprays.** *J. For.* 40, 1942 (404–10). [Bureau of Entomology & Plant Quarantine, U.S.D.A.]

A mixture of 1 part lead arsenate, 10 parts water, 0·3 part adhesive oil, with or without 0·02 to 0·03 part spreader, was applied at the rate of about 5 gal. of mixture per acre to White Pine leaders late in March or during April by means of a compressed-air sprayer to which is attached an extension rod equipped with a solid-cone type of nozzle made for applying concentrated spray. Application to plantations of 8- to 13-year-old White Pine gave excellent protection against the White Pine weevil (*Pissodes strobi*).

45.3 : 12.25 : 13.2. BALDWIN, H. I. **Protection of White Pine from weevil injury by spraying.** *Fox For. Notes* No. 32, 1942. p. 1.

From tests made with a lead-arsenate spray [cf. preceding abstract] on a 7-year-old mixed Norway Spruce and White Pine plantation and on a 13-year-old, heavily weevilled White Pine plantation, it is concluded that:—(1) Spraying should be done early in April or in the autumn. (2) Spray should be conserved by treating the bud and leader with a very narrow finely atomized solid cone spray. (3) Exposed trees of susceptible species should be sprayed at 6–7 years of age, and all trees in the area to be protected sprayed at the same time.

45.3 : 12.25 : 13.2. BRAUN, R. . Der Überwinterungsfrass der Tannenborkenkäfer. **[Hibernation mining of Silver Fir bark beetles.]** *Z. angew. Ent.* 28, 1941 (373–87). [G.] R.A.E. A30 (246–7).

Forests of Silver Fir near Vienna are severely infested by *Ips curvidens* Germ., *I. spinidens* Rttr., and *Cryphalus piceae* Ratz. The first two breed in large numbers in stacks of firewood left in the forest, and the last in fallen slash and twigs; they also breed in living trees, which are eventually killed by the injury. These bark beetles, unlike many others, overwinter in short mines in Fir trees—the two species of *Ips* in the bark of the trunks of mature trees, and *C. piceae* in the bark of branches and twigs in the crowns. In spring they leave the mines and breed in other material. The mines and the injury caused are described. The beetles bore in the same trees year after year and the bark eventually becomes scaly and detached. Layers of cork cambium are formed to shut off the mines from the living bark. Mines of *I. curvidens*, and occasionally those of *C. piceae*, reach to the sapwood, and as the layer of cork cambium extends to the cambium, the flow of sap is probably disturbed if infestation is severe. Injury by *C. piceae* is the more serious, as it is more intense and interferes with sap flow in a more susceptible region. When constructing its maternal galleries, *C. piceae* attacks the tree from above downwards, but in hibernation mining the branches die from below upwards because the older branches are longer exposed to this form of attack than the younger ones. Hibernation mining creates favourable conditions for breeding by secondary bark beetles. It is therefore essential that all sickly or dying material should be removed from the forest at once. Bark should be removed from felled

trunks and all slash should be burnt. Stacks of firewood should be removed before they become infested. Failure to apply these measures may lead in favourable weather to serious bark-beetle outbreaks. Adults of all three species emerge from their hibernation mines at about the same time, and trap logs should be placed ready to receive them; trunks injured by hibernation mining are not suitable for this purpose.

45.3 : 12.25 : 13.2. FRANZ, J. Der Tannentriebwickler *Cacoecia murinana* Hb. Beiträge zur Bionomie und Ökologie. [**Contributions to the bionomics and ecology of the Silver-Fir shoot Tortricid *Cacoecia murinana***.] *Z. angew. Ent.* 27, 1940 (345–407). [G.] R.A.E. A30 (207–8).

A detailed account is given of investigations on the bionomics and ecology of *Tortrix* (*Cacoecia*) *murinana* Hb. on *Abies alba* in a forest in Baden. Larvae of this moth were also observed on *A. grandis* in the same district.

45.3 : 12.25 : 13.2. GÖSSWALD, K. Beobachtungen über den Schutz eines Kiefernbestandes vor der Kiefernbuschhornblattwespe *Diprion* (*Lophyrus*) *pini* L. durch die rote Waldameise. [**Observations on the protection of a Pine stand against the Pine sawfly, *Diprion* (*Lophyrus*) *pini* L., by the red wood ant.**] *Z. Forst- u. Jagdw.* 72, 1940 (370–8). [G.] R.M.I.

Formica rufa pratensis is an effective agent in destroying larvae of the Pine sawfly.

45.3 : 12.25 : 13.2. HENRY, H. K. **Injury to Pines by a leaf-chafer.** *Notes For. Invest.* No. 41, 1942. p. 1. [Conservation Dept., New York.]

Note on the injury caused to the needles of Pitch, Scotch and Red Pine by the leaf chafer *Pachystethus oblivia*. Control by spraying with an arsenical or other stomach poison.

45.3 : 12.25 : 13.2. HENRY, H. K. **Factors which promote infestations of Pine-leaf scale.** *Notes For. Invest.* No. 40, 1942. p. 1. [Conservation Dept., New York.]

Factors that favour heavy infestations of *Chionaspis pinifoliae* appear to be those which cause lack of vigour in the host, such as unfavourable site, mechanical injury, other insect or fungus attack, and dust covering the trees.

45.3 : 12.25 : 13.2. HETRICK, L. A. **Life history studies of *Neodiprion americanum* (Leach).** *J. econ. Ent.* 34, 1941 (373–7). R.A.E. A30 (181–2).

A sawfly identified as *N. americanum* has defoliated Pines in scattered areas in eastern Virginia. *Pinus taeda* is the preferred food plant, *P. echinata* is infested where it occurs with *P. taeda*, but *P. virginiana* is not usually attacked. Defoliation has been more frequent in areas understocked with Pine, and where the trees retain their lower branches, than in closed stands. Most infestations were confined to areas with fine sandy soils. As the larvae eat only the old needles, the trees are not killed by repeated defoliation, but their wood production is reduced. No outbreaks of bark beetles were observed after the defoliation. In small-scale tests, sprays of 3 lb. lead arsenate per 100 U.S. gal. or 8 lb. calcium arsenate per 100 U.S. gal. with calcium caseinate as an adhesive, applied when the larvae were young, gave effective protection. Cutting infested trees in winter causes desiccation of the sawfly eggs in the needles; adequate inspection and cutting before the time of hatching for two successive winters would be necessary to destroy the eggs of the individuals that spend a second season in the soil. All stages of the pest are described and an account is given of its life history and parasites.

45.3 : 12.25 : 13.2. HOFMANN, C. Beiträge zur Bionomie des veilgrauen Kiefernspanners *Semiothisa liturata* Cl. [**Contributions to the bionomics of the violet-grey Pine looper, *Semiothisa liturata* Cl.**] *Z. angew. Ent.* 28, 1941 (324–34). [G.] R.A.E. A30 (245).

An account is given of insectary observations in Bavaria on the bionomics of *S. liturata*, which occasionally participates in outbreaks of *Bupalus piniarius* on Pine in Germany. Pines are the chief food plants, but the larvae have also been recorded from Spruce, Juniper, and Silver Fir. A list of parasites is also furnished.

45.3 : 12.25 : 13.2. KOMÁREK, J., and KOLUBAJIV, S. Einige Beobachtungen über den Kiefernspinner. [**Some observations on the Pine lappet moth (*Dendrolimus pini*).**] *Cbl. gesamte Forstw.* 67, 1941 (245–51). [G.]

An account of observations during a recent outbreak in the Elbe valley in Czechoslovakia. Damage was confined to pure Pine stands with sandy soils free of grass but having a sparse moss cover. It did not affect mixed Pine/Oak stands and did not develop in Pine stands with grass growth. In spite of the exceptionally severe frosts that prevailed during the winters of 1939–40 and 1940–41, the larvae wintering in the soil under the moss cover were not affected by the cold. The many hymenopterous and other parasites (lists of which are included in the paper) that were present in the locality did not check the outbreak effectively. An unusual, so far unexplained, disease, which appeared in spring 1941, eventually checked the outbreak.

45.3 : 12.25 : 13.2. NOLTE, H.-W. Der Sammelfehler beim Probeeiern zur Nonnenprognose. [**The collectors' error in egg sampling for the forecasting of nunmoth populations.**] *Thar. forst. Jb.* 93, 1942 (194–201). [G.g.] [Forschungsstelle für Nonnenbekämpfung der Sächsischen Forstlichen Versuchsanstalt, Tharandt.]

The investigations described have shown that about one-third of the eggs actually present are overlooked in the case of Spruce and slightly less than one-half in Scots Pine.

45.3 : 12.25 : 13.2. SCHIMITSCHEK, E. Beiträge zur Forstentomologie der Türkei III. Die Massenvermehrung des *Ips sexdentatus* Börner im Gebiete der orientalischen Fichte. II. Teil. [**Contributions to the forest entomology of Turkey. III. Outbreaks of *Ips sexdentatus* in the Oriental Spruce region. Part II.**] *Z. angew. Ent.* 27, 1940 (84–113). [G.] R.A.E. A30 (164).

Forests of *Picea orientalis* in the region of Trebizond have been heavily attacked in the last 10 years by *I. sexdentatus*. This Scolytid has two generations and a partial third in average years. It normally attacks only unhealthy trees, fresh stumps and unbarked logs lying in the forest, but if unchecked it multiplies rapidly and infests healthy trees, causing their death. It has many natural enemies, but these are never sufficient to control an outbreak unaided. Infestation of living trees can be recognized by the frass expelled during the formation of the breeding galleries, the exudation of resin, and finally the discoloration of the crowns. Control measures should be applied before this last stage is reached, as by that time the young adults are ready to emerge. Trap logs should be felled 2–3 weeks before

each flight period. All infested trees should be felled and the bark should be completely removed and burnt. Infestation can be prevented to a great extent by preserving mixed forests in which Spruce predominates. Parasites of *I. sexdentatus* and other insects accompanying or following its attacks are also discussed.

45.3 : 12.25 : 13.2. WATANABE, C. **Descriptions of three new species of *Aphidius* parasitic on some aphids of coniferous trees. (Taxonomic notes on Aphidiidae of Japan, III.).** *Insecta matsum.* 15, 1941 (106–11). R.A.E. A30 (160).

The new species are (i) *Aphidius jezoensis*, bred from *Cinara nopporoensis* Inouye and *Lachnella costata* Zett., both on *Picea jezoensis* and *P. glehni*; (ii) *A. inouyei* from *Cinara todocola* Inouye; and (iii) *A. kônoi* from *C. longipennis* Mats. The tree host of the two latter *Cinara* spp. was *Abies sachalinensis*. Details are also appended of differences observed between females of *Coelonotus* (*Aphidius*) *pini* Hal. bred from *Cinara pinea* Mordv. (*pineti* Koch) on *Pinus densiflora* and those previously reared from *C. laricicola* Mats.

45.3 : 12.25 : 13.2. WYGANT, N. D. **An infestation of the pandora moth, *Coloradia pandora* Blake, in Lodgepole Pine in Colorado.** *J. econ. Ent.* 34, 1941 (697–702). R.A.E. A30 (356).

In August, 1937, an outbreak of this Saturniid was discovered on *Pinus contorta* var. *latifolia* in the Arapaho National Forest, north-central Colorado. This is the first known record of its building up to outbreak proportions in pure stands of Lodgepole Pine. The outbreak seemed likely to become very serious until 1939, when natural control factors greatly reduced the population. There was at least 50 per cent. mortality among the larvae in the winter of 1938–9, probably through low temperatures. A wilt disease killed about 60 per cent. of the remaining larvae in June–July, 1939. When the larvae were entering the soil in July about 43 per cent. of the remaining population were killed by heat and drought effects. Only one species of parasite, *Apanteles* sp., was reared. Bears and squirrels fed on the pupae. Notes are included on the life cycle of the moth.

45.3 : 12.25 : 13.2 : 13.15. YUILL, J. S. **Cold hardiness of two species of bark beetles in California forests.** *J. econ. Ent.* 34, 1941 (702–9). R.A.E. A30 (356–7).

The results are given of laboratory studies on last-instar larvae of *Dendroctonus brevicomis* Lec., which attacks *Pinus ponderosa*, and of *D. monticolae* Hopk., which attacks several species of *Pinus*.

45.3 : 12.25 : 13.2 : 22.14.2. ORR, T. J. **Reducing Pine beetle damage through partial cutting.** *W. Cst. Lumberm.* 69 (4), 1942 (42, 44, 46, 79). [Weyerhaeuser Timber Co.]

The possibility of applying partial cutting techniques to specific areas in salvage operations will depend mainly on two factors:—(1) The added cost of logging that can be justified by the value of the timber lost, and (2) the ability of the technician to select trees on the basis of their susceptibility to insect attack. The author discusses the application of 'sanitation-salvage cuttings' in mature Ponderosa Pine stands in eastern Oregon with reference to selection of area to be cut, determination of amount to be cut, marking and cutting technique, and the costs and results of the operation.

45.3 : 12.25 : 13.2 : 23.24.3. LITTLEFIELD, E. W. **White Pine weevil damage reduced by close spacing.** *Notes For. Invest.* No. 37, 1942. p. 1. [Conservation Dept., New York.]

Of two small plantations of White Pine on similar sites, the plot with an original spacing of about 3·5 ft. × 3·5 ft. showed 76 per cent. of the trees to have been weevilled in some degree and 79 per cent. of the weevilled trees to have made good recovery, while with a spacing of 6 ft. × 6 ft., 96 per cent. of the trees were weevilled and only 4 per cent. of these showed good recovery.

45.3 : 12.25 : 13.2 : 31.4. RILEY, C. G., and SKOLKO, A. J. **Rate of deterioration in Spruce killed by the European Spruce sawfly.** *Pulp Paper Mag. Can.* 43 (7), 1942 (521–4). [Science Service, Department of Agriculture, Ottawa.]

Report of a study showing that the rate of sapwood decay of Spruce, caused mainly by *Fomes pinicola* and *Polyporus abietinus*, is much higher in sawfly-killed trees than in bark-beetle-killed trees, the per cents. of merchantable volume decayed after 5–6 years being 44 and 4 respectively. This has been correlated with the fact that the bark becomes loosened on bark-beetle-killed trees and the wood is allowed to dry out, sap rot being concentrated toward the base of the tree where the wood is moister [cf. *For. Abs.* 2 (222)], whereas on sawfly-killed trees the bark remains relatively intact, maintaining a higher moisture content throughout the stem. Breakage must also be considered as a factor in the deterioration of sawfly-killed Spruce.

45.3 : 12.25 : 13.2 : 31.43. **Insect pests.** *Agric. Gaz. N.S.W.* 52, 1941 (321–5). R.A.E. A30 (231–2).

Diadoxus erythrurus White infests *Callitris* and *Cupressus*, both healthy and injured and sickly trees being attacked, though the latter appear more susceptible. Adults of this Buprestid occasionally emerge from the timber after it has been used in flooring, but no reinfestation occurs.

45.3 : 12.25 : 13.2 : 42.1 : 31.43 : 32.82. TRÄGÅRDH, I. Neue Beobachtungen über den Schusterbock (*Monochamus sutor* L.) in Schweden. [**New observations on *M. sutor* in Sweden.**] *Z. angew. Ent.* 27, 1940 (142–9). [G.] R.A.E. A30 (164–5).

An account in German of the investigations noted in *For. Abs.* 1 (238–9) and 2 (53).

45.3 : 12.25 : 13.2 : 43.3. PARMELEE, F. T. **Long-horned and flatheaded borers attacking fire-killed coniferous timber in Michigan.** *J. econ. Ent.* 34, 1941 (377–80). R.A.E. A30 (182–5).

In 1937, recently cut logs and branches of *Pinus strobus*, half of which were scorched by burning kerosene smeared over the bark, were exposed in a sunny position from 13th May to 20th September and subsequently caged. Four species of Longicorns and a Buprestid were reared from the wood, most of the serious heartwood damage being caused by *Monochamus scutellatus* Say. *Asemum moestum* Hald. reached the heartwood of the branches but was too scarce to be important. The superficial burning appeared to have a repellent effect.

In November, 1938, heavily infested timber of 3 species of Pine was obtained from an area that had been cut over during the previous winter; all slash had been left in the clearings, and a small fire had destroyed some of the slash and killed some of the surrounding

trees. In addition, infested timber of *P. banksiana*, *Abies balsamea*, and Larch was collected from other localities. In October, 1939, timber was obtained from nearly 30,000 acres of coniferous forest that was burnt in May, 1939, most of the trees being killed or severely injured. *P. banksiana* was the dominant species throughout, but other native conifers were generally distributed. Seven Longicorns and four Buprestids were reared from the 1938 material, and three Longicorns from that of 1939. In both cases *M. scutellatus* was the most injurious. Fungal infection in the heartwood was observed only where the latter was penetrated by tunnels of this beetle. In neither year were uninjured trees near the burnt area affected by the heavy concentration of secondary wood-destroying insects within it, though some injured trees that might have recovered were killed by bark beetles. Results from the 1938 material confirmed that fire-killed timber does not necessarily attract ovipositing beetles because of the effect of the burning. Parasites and predators did not appear to be of much importance in destroying wood-boring larvae in 1939.

Timber is most attractive to wood-boring Coleoptera during the first year after the death of the trees, and these borers will not usually reinfest trees from which they have emerged as adults. Species that prefer wood in a more advanced stage of decay are of little importance. Injury occurs mainly in the trunks and larger branches. *Pinus strobus* is the favourite food plant for *Monochamus* as well as other boring beetles, and *P. resinosa* is much less heavily infested than other conifers.

45.3 : 12.26–8 : 12.21 : 13.2 : 24.51. BAKER, W. C. **Type of wood preferred by Coleoptera commonly found in decadent parts of living Elm trees.** *J. econ. Ent.* 34, 1941 (475–6). R.A.E. A30 (199).

The size and condition of the branches in which various beetles were found during sanitation prunings are discussed in relation to the effectiveness of such operations. *Scolytus multistriatus* and *Hylurgopinus rufipes* were among the commoner species attacking dead and dying wood.

45.3 : 12.26–8 : 13.2. BEAL, J. A., and MASSEY, C. L. **Two important pests of Hickory reproduction in the Southeast.** *J. For.* 40, 1942 (316–8). [Duke University.]

Brief notes are given on the life history and habits of the Hickory twig girdler (*Oncideres cingulatus*) and the Hickory spiral borer (*Agrilus arcuatus* var. *torquatus*) together with an account of the character and amount of damage caused by these insects to young Hickory stands in the Duke Forest. Results of a study of egg and larval mortality of the Hickory twig girdler are recorded. Parasites, predators and associated insects are listed for both species.

45.3 : 12.26–8 : 13.2. HARRISON, G. H. **Notes on the genus *Psyllopsis* Löw (Hem., Psyllidae) with special reference to the British species found on *Fraxinus*.** *Ent. mon. Mag.* 78, 1942 (155–60). [King's College, Newcastle-upon-Tyne.]

Even the heaviest infestations with *P. fraxini* and other Ash Psyllids fail to injure the trees permanently.

45.3 : 12.26–8 : 13.2. HASEMAN, L. **The spring canker-worm and its control.** *Circ. Mo. agric. Exp. Sta.* No. 205, 1940. pp. 4.

A brief description and life history is given of *Paleacrita vernata*. The foliage of Apple, Elm and Hackberry is favoured by this insect although it feeds on the foliage of many other trees and shrubs. Most effective control is a spray containing 2–3 lb. of arsenate of lead in 100 gal. of water, applied to trees not too large to treat thoroughly just after leaves begin to develop, or when worms first appear.

45.3 : 12.26–8 : 13.2. KANGAS, E. *Agrilus ater* L., als Espenschädling in Finnland. [***Agrilus ater* L. as a pest of Aspen in Finland.**] *Z. angew. Ent.* 28, 1941 (359–65). [G.] R.A.E. A30 (245–6).

A. ater has recently been observed severely injuring *Populus tremula* in southern Finland. Other primary pests present in the trees were *Saperda carcharias* L., *S. perforata* Pall., *Xylotrechus rusticus* L., *Cryphalus bispinulus* Egg., *Xyleborus cryptographus* Ratz., and *Poecilonota variolosa* Payk. Secondary pests were numerous. Entomological analyses of three infested trees in different stages of withering indicate that *A. ater* is one of the most important primary pests of Aspen, together with *S. carcharias* and *P. variolosa*. It attacks chiefly the lower part of the trunks of large trees that are still apparently healthy. Its life history is briefly reviewed from the literature. The larvae mine in the cambium and only occasionally touch the sapwood; they pupate in the hard bark of the trunk. The only parasite observed was the Braconid *Ipobracon nigrator* Zett., but many larvae were found dead in their mines, having apparently been killed by a fungus.

45.3 : 12.26–8 : 13.2. MANNING, J. D. **Damage to Red Gum seedlings by termites.** *Pap. Tea sci. Sect. U.P.A.S.I.* No. 2, 1940 (16–8). R.A.E. A30 (338).

In view of reports from estates in South India of root damage to seedlings of *Eucalyptus rostrata* planted in clearings, investigations were made on a 20-acre clearing in the Nilgiri-Wynaad at an altitude of 2,500 ft. The stock had been raised in baskets in a nursery, and the baskets were placed in pits in the clearing in May–June. After a few weeks the plants wilted, and examination showed that the main roots had been attacked just below the soil surface by *Termes feae* Wasm., which is primarily a wood tunneler and commonly infests buildings. Suggested control measures include treatment of the baskets with a poison before use, and watering the pits with nicotine water, prepared by steeping tobacco leaves. Where damage is severe, baits of wood poisoned with Paris green (1 part Paris green to 100 parts wood) or soaked in a 10-per-cent. solution of sodium arsenite can be used.

45.3 : 13.15. SCHWERDTFEGER, F. Über die Ursachen des Massenwechsels der Insekten. [**On the causes of variation in abundance of insects.**] *Z. angew. Ent.* 28, 1941 (254–303). [G.] R.A.E. A30 (244).

A detailed discussion of theories that have been advanced.

45.3 : 13.15 : 13.2. JANISCH, E. Über die Bewertung der Mortalitätsfaktoren beim Massenwechsel von Schadinsekten. [**On the evaluation of mortality factors in the variation of abundance of insect pests.**] *Z. angew. Ent.* 28, 1941 (241–53). [G.] R.A.E. A30 (244).

45.3 : 13.2. UNITED STATES. **Twenty-first annual report, Southern Forest Experiment Station.** New Orleans, La. 1941. pp. 21.

Successful control of the Texas leaf-cutting ant was obtained by applying methyl bromide at the rate of 1 lb. in from 1 to 4 ant tunnels before planting trees,

the tunnels being left open. Experiments have indicated that injury to young southern Pine trees by the Pine tipmoth can be reduced by the use of good quality planting stock and the planting of better-quality sites (p. 15).

45.3 : 13.2. WHITTEN, R. R., POTTS, S. F., and FRANCIS, E. H. **Concentrated spray applied with an autogiro for control of cankerworms.** *J. econ. Ent.* 34, 1941 (692–6). R.A.E. A30 (355–6).

Woodland infested by *Paleacrita vernata* Peck and *Alsophila pometaria* Harr. was treated by spraying or dusting from an autogiro and by power spraying from the ground. Data are given on the comparative larval feeding and mortality after each treatment and on the spray distribution and adherence obtained with the two types of sprayers. The insecticides used were (i) a concentrated spray of 200 lb. acid lead arsenate, 10 U.S. gal. fish oil and 1½ gal. light paraffin oil per 70 gal. water, at the rate of about 22 lb. lead arsenate per acre; (ii) a proprietary colloidal lead-arsenate spray containing lead arsenate equivalent to 11·5 per cent. As, at about 3·6 lb. lead arsenate per acre; (iii) a dust of lead arsenate impregnated with 14 per cent. by weight heavy paraffin oil, at about 33 lb. per acre; and (iv) a spray of 5 lb. lead arsenate and 20 oz. fish oil per 100 gal. water, at about 27·5 lb. lead arsenate per acre. The first three preparations were applied by autogiro, the fourth from ground level. Spray deposition was about the same in plots treated with the concentrated mixture from the autogiro and that applied from the ground, but the former gave a better deposit on the top of the canopy, where much of the larval feeding occurs. The deposit was low for plots sprayed with colloidal lead arsenate. The concentrated spray had better adherence. The dust gave considerable control, but drifting and loss of dust from the foliage prevented the treatment from being entirely satisfactory. There was more than 13 times as much feeding in the untreated plot and more than 4 times as much in that sprayed from the ground as in that treated with the concentrated spray from the autogiro, and more dead larvae were recovered in the latter than in either of the others.

45.3 : 13.2 (59). TAKAHASHI, R. **Some injurious insects of agricultural plants and forest trees in Siam and Indo-China.—I, Aphididae.** Formosa [Taiwan] Govt. Agr. Res. Inst. Rpt. 78, 1941. pp. [1] + iii + 27. E.S.R. 86 (353).

45.3 : 13.2 : 13.15. BEREZINA, V. M. **Effect of hydrothermic soil conditions on the vertical migration of the cockchafer larvae *Melolontha hippocastani*.** *Bull. Plant Prot.* 1940 (5), 1941 (43–56). [R.] R.A.E. A30 (332).

A detailed account is given of investigations on the effect of temperature and humidity on the vertical migration of larvae of *Melolontha hippocastani* F. in the soil.

45.3 : 13.2 : 13.15. BROWN, A. W. A., and DAVIAULT, L. **A comparative study of the influence of temperature on the development of certain sawflies after hibernation in the cocoon.** *Sci. Agric., Ottawa* 22, 1941–42 (298–306). [Science Service, Dominion Department of Agriculture, Ottawa.] E.M.B.

The results are given of laboratory experiments on the effect of thermal conditions upon *Neodiprion pinetum*, *N. swainei*, *N. lecontei*, *N. dubiosus*, *Pikonema dimmockii* and *alaskensis*, and *Pristiphora geniculata* and *erichsoni*. Field observations on some of these species show a measure of agreement with those in the laboratory. The bearing of the results on the ecology of these sawflies is briefly discussed.

45.3 : 13.2 : 13.15. FAHRINGER, J. Zur Kenntnis der Parasiten der Nonne (*Lymantria monacha* L.). [**The parasites of the nun moth (*Lymantria monacha* L.).**] *Z. angew. Ent.* 28, 1941 (335–58). [G.] R.A.E. A30 (245).

45.3 : 13.2 : 13.15. KOZHANCHIKOV, I. V. **The importance of the physical conditions of environment in the development of the eggs of the gipsy moth (*Lymantria dispar* L.).** *Bull. Plant Prot., Leningrad* 1940 (3), (3–16). [R.r.] R.A.E. A30 (233).

The thresholds of development and the sums of effective temperatures necessary for the development of the eggs are closely connected with those characteristic of deciduous trees, especially some of the most important food plants of the larvae, such as Willow. The relationship with the development of conifers is less close.

45.3 : 13.2 : 13.15. MAYER, A. Ernährungsphysiologische Untersuchungen an Nonnenraupen (*Lymantria monacha* L.). [**Investigations on the physiology of nutrition of larvae of the nun moth (*Lymantria monacha* L.).**] *Z. angew. Ent.* 27, 1940 (157–207, 408–49). [G.] R.A.E. A30 (206–7).

45.3 : 23.27. FELT, E. P., and BROMLEY, S. W. **New and unusual shade tree pests.** *J. econ. Ent.* 34, 1941 (383–6). R.A.E. A30 (184–5).

Notes on *Olene basiflava* Pack., on *Ulmus fulva*, *Quercus alba*, and other species; *Symmerista albifrons* S. & A., on *Quercus*, *Fagus*, *Castanea*, and *Betula*; *Ennomos subsignarius* Hb. on *Acer rubrum* and other species; *Phlepsius ishidae* on Apple and *Corylus*; *Hylobius radicis* Buchanan and *Pissodes approximatus* on *Pinus nigra* var. *austriaca*; spraying of *Ulmus* against *Scolytus multistriatus*; natural enemies of *Toumeyella liriodendri* Gmel.; and spraying of *Salix nigra* against gall-forming insects.

45.3 : 23.27. FELT, E. P. **Borers of shade and ornamental trees.** *Trees, Sta. Monica, Calif.* 5 (3), 1942 (6, 8). [Bartlett Tree Research Laboratories, Stamford, Conn.]

Short notes are provided on common insect borers, arranged under the tree hosts, with suggestions for their control.

45.3 : 23.26. SORACI, F. A. **Important nursery insects of New Jersey.** *Circ. N.J. Dep. Agric.* No. 326, 1941. pp. 72.

Brief notes are given on general appearance, life history, food plants and control measures for each insect, including a number of forest nursery pests.

47. COLLECTIVE INJURIES TO INDIVIDUAL TREE SPECIES

47 : 12.26–8 : 23.26. DAVIS, W. C., WRIGHT, E., LATHAM, D. H., YOUNG, G. Y., LAMB, H., and HARTLEY, C. **Diseases of forest-tree broadleaf nursery stock.** Civilian Conservation Corps, U.S. Department of Agriculture, Washington, D.C. 1941. pp. 38. [Bureau of Plant Industry, U.S.D.A.]

Notes on common diseases and their control.

5. MENSURATION. INCREMENT. YIELD

52. MEASUREMENT OF TREES AND TIMBER

52.1. *Diameter*

52.1 : 07.7. TISCHENDORF, W. Die zulässige Klassenweite beim Messen mit selbstabrundenden Kluppen. **[The permissible size of diameter classes in measuring with calipers having provision for automatic reduction to round figures.]** *Cbl. gesamte Forstw.* 68, 1942 (28–52). [G.]

A theoretical discussion of the errors resulting from the reduction of caliper measurements of tree diameters to round figures, supplemented by field data showing the percentage error in the average basal area of a stand using different sizes of diameter classes. This error is mostly positive. It tends to be greater in stands with a consistently declining stem-distribution (number of stems per diameter class) curve than in those with a curve having an ascending as well as a descending portion; greater in stands with a small average diameter than in those with a large average diameter; and greater in stands with a small number of trees than in those with a large number. Four- or five-cm. diameter classes are satisfactory for stands of large population (over 1,000 trees) and large average diameter (over 30 cm.), and having a stem-distribution curve with an ascending as well as a descending portion. Under these conditions the error due to the reduction of the diameter to round figures is well within 1 per cent. In other stands, smaller diameter classes may be required.

52.1 : 07.7. WILJAMAA, L. E. **A simple but practical Finnish instrument for measuring tree diameters.** *J. For.* 40, 1942 (506–7). [Superior National Forest.]

The instrument, consisting of a straight and parabolic scale radiating from a common origin, is easily made, cannot get out of adjustment, and is as reliable as calipers for measuring diameters to the nearest inch.

52.4. *Measurement of Volume*

52.43.3 : 52.46 : 60.31.2. COOPER, W. E. **A common denominator method of estimating timber.** *J. For.* 40, 1942 (397–400). [Clemson College, South Carolina.]

Description of a method for quick and satisfactory estimate of volume per acre, particularly in even-aged stands. The basic unit volumes in bd. ft. are those for 2-log trees for each 2-in. diameter class, obtained from a specially prepared local volume table. A common denominator of 40 bd. ft. is divided into the unit volumes of each diameter class thus giving simplified figures that are accurate enough for practical purposes and are easily totalled in the field. In applying this method, using $\frac{1}{5}$-acre plots, the simple numbers, corresponding to the diameter classes of all trees to be tallied, are added, a percentage adjustment is made if the average height of all the trees is more or less than 2 logs, and the figure obtained is multiplied by 200 (40×5) to bring it to bd. ft per acre.

54. FACTORS CONNECTED WITH ASSORTMENT

54 : 33.17 : 12.25. NILSEN, J., and SLEPPEN, J. **Research on the yield of sawn material from Scots Pine.** *Medd. Vestl. forstl. Forsøkssta.* No. 24, 1941. pp. 45. [Nor.g.] *Abstr.* in *Holz* 4, 1942 (292–3). [G.] P.R.

A study of mill yields from a total of 536 stems. Data are given on the lumber yield, stave-wood yield of slabs, sawing time, and volume by length and top diameter for material in log form, while for material considered as whole stems the figures relate to stave-wood yield of the smaller diameters, lumber yield of the larger diameters, stave-wood yield from tops and slabs of the larger diameters, and sawing times for each of the two major diameter groups.

56. INCREMENT

56 : 12.25. ZIMMERLE, H. Zuwachsuntersuchungen bei der Fichte und Tanne im württ. Forstbezirk Pfalzgrafenweiler. **[Increment investigations on Norway Spruce and Silver Fir in the forest district of Pfalzgrafenweiler, Württemberg.]** *Allg. Forst- u. Jagdztg.* 118, 1942 (32–41, 67–74, 92–105). [G.]

The chief purpose of this investigation, as of those previously conducted at Härtsfeldhausen [cf. *For. Abs.* 1 (40)] and at Gaildorf [cf. *For. Abs.* 1 (299)] was to compare the increment of the 'external' trees (trees from the zone outside the internal strip or 'Innensaum' which had been gradually freed through thinnings under the Wagner *Blendersaumschlag* system) with that of control stems inside the forest. This time, however, only in some of the plots did the external trees put on more increment than comparable control stems; also, the relative improvement in stem form of the external trees, through their putting on light increment higher up the stems, was observed in some cases only. The differences in the results obtained at Pfalzgrafenweiler on the one hand and at Härtsfeldhausen and Gaildorf on the other are ascribed chiefly to differences in climate, particularly the higher rainfall at Pfalzgrafenweiler, where in some of the plots the additional moisture gained by the 'external' trees was of no benefit.

56.01 : 11.11 : 12.11.23. MORK, E. **[On the relation between temperature and growth. Research on the daily variation of height growth.]** *Medd. norske Skogforsøksv.* 8 (1) [No. 27], [1941?] (1–76). [Nor.g.] *Abstr.* in *Thar. forstl. Jb.* 93, 1942 (224–5). [G.]

The daily trend of height growth in Norway Spruce was found to show a marked retardation in the morning hours, while in the afternoon and night it rose to a higher but approximately uniform level. The total daily growth showed a very considerable dependence upon temperature, particularly the mean of the six warmest hours. The height growth observed at 8° C. was doubled at 14° and rose to seven times as much at 24°. The findings are discussed from a physiological point of view.

56.02 : 11.21 : 09.2. DOUGLASS, A. E. **Cross-dating at Mesa Verde National Park.** *J. For.* 40, 1942 (347–8). [Laboratory of Tree-Ring Research, University of Arizona.]

Curves showing the average ring growth obtained from old trees (Douglas Fir 500 years old or more) in three different groves are very similar in detail showing that the ring characters in the trees of these groves are general. Available moisture is the significant factor determining growth in this region.

56.02 : 11.21 : 09.2 (73). HAWLEY, F. **Tree-ring analysis and dating in the Mississippi drainage.**—With appended papers—*Reflection of precipitation and temperature in tree growth* [by] Mildred Mott Wedel and Florence Hawley, [and] *A new dendrochronograph* [by]

E. J. Workman and Florence Hawley. *University of Chicago Publications in Anthropology, Occasional Papers* No. 2, 1941. pp. 110 + figs. & gphs.

56.02 : 21.8 : 11.21 : 12.11. Topcuoglu, A. Die Verteilung des Zuwachses auf die Schaftlänge der Bäume. **[The distribution of diameter increment along the stem of trees.]** *Thar. forstl. Jb.* 91, 1940 (485–554). [G.] *Abstr. in Holz* 4, 1941 (290–1). [G.] P.R.

Measurements of material representing the whole stem length of dominant, co-dominant and suppressed Norway Spruce from three different sites showed that the diameter increment of the clear bole was least at heights between 1·3 and 6·7 m.—on an average at 21 per cent. of the stem length. In dominant trees the longitudinal distribution of increment was not correlated with precipitation. In co-dominant, and even more so in suppressed trees, growth took place farther down the stem in dry years, the minimum occurring in particularly dry years in the neighbourhood of the crown base, whereas in wet years the reverse condition held good. Site had no effect on the longitudinal variation of diameter increment.

Diameter increment started in Beech, Ash, and Oak at about the middle of May and in Norway Spruce and Scots Pine at the end of this month. In Scots Pine, increment at 6 m. height began noticeably earlier than at 2 m. The diameter increment of the roots began 2–4 weeks later and the lag increased with increasing distance from the stem base. The amount of diameter increment of the stem at 2 m. height was always less in the initial period than that at 6 m. height. Cambium was active in the conifers from mid-May to mid-September, and late wood was formed from the middle or end of July onwards; in the hardwoods diameter growth lasted from early May to the end of August. Diameter growth of the roots ceased between the middle and end of November.

Bark was easy to separate from the wood at the onset of cambial activity but its attachment became firmer as soon as the first early-wood cells were formed.

Determinations of the sugar content of sieve-tube sap in Oaks and Lime showed that the concentration decreased at successively lower levels in the stem, e.g. in Red Oak at the rate of 0·24 per cent. per metre of stem. Open-grown trees had values about 1 per cent. higher than those in stands. Site was without effect. The findings are discussed from a physiological point of view.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

57 (71.4). Candy, R. H. **Forest growth on the Upper Lièvre Valley, P.Q.** *Silvic. Res. Note Dom. For. Serv.* No. 71, 1942. pp. 25.

This report compares the results from two rate-of-growth forest surveys made in 1930 and 1940 in the Upper Lièvre District, Quebec. The principal species include Spruce, Balsam Fir, Jack Pine and White Birch. Although the area has not been cut, the stands have been considerably disturbed by severe infestation of budworm (*Cacœcia fumiferana*), which killed much of the Balsam Fir and damaged the Spruce, and by wind storms, and more recently by high mortality in overmature Jack Pine and White Birch.

In 1940 the stand per acre totalled 2,411 cu. ft. (1,775 cu. ft. merchantable) in 1,238 trees (317 merchantable), the pulpwood species (Spruce and Balsam Fir) being represented by 1,398 cu. ft. in 1,124 trees. During the 10-year period between the two surveys, the stand increased in stocking by 210 trees per acre and there was an average annual increment for the ten years of 47·4 cu. ft. compared with 37·8 cu. ft. estimated at the time of the first survey. Comparable figures for the pulpwood species only are 238 trees, 43·1 cu. ft. and 23·6 cu. ft. respectively. The high increment recorded is due largely to the fact that the stands are understocked as a result of the high mortality, which has increased during the 1930–40 period, being heaviest in Balsam Fir, Jack Pine and White Birch. Percentage of total volume defective was: Spruce 3·5, Balsam Fir 10, Aspen 19, White and Yellow Birch 26, and Maple 14.

57.0 : 12.25 : 12.11.3 : 21 : 31.2. Burger, H. Holz, Blattmenge und Zuwachs. V. Fichten und Föhren verschiedener Herkunft auf verschiedenen Kulturorten. **[Wood, quantity of foliage, and increment. V. Norway Spruce and Scots Pine of different provenance on different plantation sites.]** *Mitt. schweiz. Anst. forstl. Versuchsw.* 22, 1941 (10–62). [G.g.f.]

A. Investigations on 40-year-old plantations of Spruce of Winterthur provenance (500 m. elevation) and of Engadin provenance (1,850 m. elevation) grown at Solothurn (= Soleure, 470 m. elevation) and at Bergün (1,600 m. elevation). At Solothurn, the Winterthur race gave much better height and diameter growth than the Engadin race; at Bergün the two races showed the same increment. At Solothurn, the Winterthur race required about 1,640 kg. of fresh needles for the annual production of 1 cu. m. of stemwood, while the Engadin race required 1,890 kg.; at Bergün the corresponding figure was 2,500 kg. for both races. At Solothurn, the Winterthur race had, per ha., about 44,000 kg. (fresh weight) of needles with a surface of 280,000 sq. m., while the Engadin race had 36,000 kg. with 240,000 sq. m. of surface; at Bergün both races had 33,000 kg. of needles with a surface of 170,000 sq. m. The density of the green wood was higher at Solothurn than at Bergün. On both sites it was higher for the high-mountain race than for the lowland race. The average density of the wood when oven-dry did not vary significantly with either race or site. Race did not appear to influence the extent of volume shrinkage of the wood in drying, but shrinkage was greater in the Solothurn wood than in the Bergün wood, in spite of the two having much the same density when dry. The greater shrinkage of the Solothurn wood was due to the more pronounced differences in the density of its spring and summer wood as compared with the wood from Bergün. At both Solothurn and Bergün the water content of the wood of the Engadin race was higher than that of the Winterthur race. In both races, the wood had a much higher water content at Solothurn than at Bergün.

B. Investigations on 32-year-old Scots Pine trees of different provenance grown at Eglisau (410 m. elevation), Magglingen (= Macolin, 1,070 m. elevation) and Samaden (1,920 m. elevation). The average height of the trees decreased with the elevation at which they were grown. The height/diameter ratio was generally above 100 m. at Eglisau, 65–80 at Magglingen, and 50–60 at Samaden. The annual production of 1 cu. m. of stemwood required on an average about 1,000 kg. of fresh needles at Eglisau, 1,250 kg. at Magglingen, and 3,000 kg. at Samaden. Pines of different provenance grown on the same site required different amounts of needles

to produce the same increment. The density of the fresh wood averaged 0·97 at Eglisau, 0·92 at Magglingen, and 0·87 at Samaden; the corresponding figures for oven-dry wood were 0·45, 0·40, and 0·38. The density of oven-dry wood grown on the same site varied with the race. Volume shrinkage of the wood in drying decreased with the elevation at which the wood was grown. The water content of the wood increased with the elevation—the opposite to that observed in the case of Spruce.

57.0 : 12.25 : 56 : 21.6. ROBERTSON, W. M. **Some growth characteristics of Red Spruce.** *Silvic. Res. Note Dom. For. Serv.* No. 70, 1942. pp. 7 + gphs. + tbls.

Analysis was made of the radial growth per decade of stump measurements of 191 Red Spruce 9 to 20 in. d.b.h., from an uneven-aged stand that had been undisturbed prior to 1850, when it was cut selectively. Growth characteristics noted include:—(1) Tendency to become many-aged. (2) Remarkable persistence under suppression. (3) Growth rate under suppression is about 15–20 years per inch of diameter. (4) Growth rate when released is as high as 1 in. in 8–10 years. *From author's summary.*

57.0 : 12.26–8 : 2 (494). BADOUX, E. Les cultures de peuplier du Fort (canton de Vaud). **[The Poplar plantations of Le Fort (Canton of Vaud).]** *J. for. suisse* 93, 1942 (33–9). [F.]

Includes growth data from a young plantation of the Sarcé and Raverdeau forms of × *P. serotina.*

57.0 : 23.1 : 12.25 : 33.02 (77.4). BOWMAN, A. B. **Growth on cutover Spruce-Fir pulpwood lands in northern Michigan.** *Pap. Mich. Acad. Sci. 1940*, 26, 1941 (123–33). [Michigan State College, East Lansing.] L.S.

(i) The most important factors affecting volumes on cut-over areas are residual basal area at time of cutting, elapsed time after cutting, and site quality, which in this study was assumed to coincide with the former forest type. (ii) Charts and tables have been prepared from the collected data to predict future volumes. A field survey to determine type, acreage, and residual basal area is a necessary preliminary. (iii) Growth in merchantable volume averages for the Black Spruce type, 0·20 cord per acre per year; for the Northern White Cedar type, 0·45 cord; and for the White Spruce/Balsam Fir/Paper Birch type, 0·55 cord. (iv) Growth rates of Spruce and Fir compare favorably with those of associated species and show that, if these species are given a fair chance, they will maintain themselves against all opposition. (v) Heavy cutting is more inclined to cause changes in composition in the White Spruce/Balsam Fir/Paper Birch type than in the Black Spruce type, although it is not so apt to denude the site. (vi) Recovery of cut-over Spruce/Fir pulpwood lands depends on (*a*) the nucleus of Spruce and Fir left after logging, (*b*) the rates of growth of these and associated species, (*c*) the dominance of inferior species left after logging, and (*d*) the tendency of shrubs to monopolize the site. *From author's summary.*

57.0 : 65. KÜGLER, F. Beobachtungen über die natürliche Zusammensetzung von Althölzern und die Verteilung der Stammzahlen und des Vorrates auf die Stärkegruppen in Lettland. **[Observations on the natural constitution of old forests and the distribution of stems and of the growing stock by diameter classes in Latvia.]** *Z. Forst- u. Jagdw.* 74, 1942 (179–83). [G.]

The writer observed that in almost unthinned old stands (mostly 110–120 years old) of Pine, Spruce, or a mixture of the two, the growing stock varied but little for a given stand height and species composition. For a given stand age and stand distribution by diameter classes and species, the mean height of the stand could be easily guessed. Although the Spruce stands had much the same volume as had comparable Pine stands, the distribution of the stems by diameter classes was quite different for the two species.

57.6 : 12.25 : 22.88.2 : 32.29.2. MCCULLOCH, W. F. **Mortality in a second-growth Douglas Fir stand after logging and slash burning.** *W. Cst. Lumberm.* 69 (6), 1942 (41). [Oregon State College School of Forestry, Corvallis.]

Extreme mortality occurred in a 65-year-old Douglas Fir stand during the four years following a heavy partial cutting and slash burning, the residual stand being reduced from 181 to 42·2 trees per acre. Death was due in the first place to a hot slash fire in a thin-barked stand. After the first year, beetle attack and windfall were contributing causes.

57.9 : 12.26–8. RAM, B. S. **Provisional yield tables for *Dalbergia sissoo*, Linn. f. in the irrigated plantations of the Punjab.** *Indian For. Rec.* (*n.s.*) *Silviculture* 4–A, 1941 (v + 117–43). [Forest Research Institute, Dehra Dun.]

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

60 : 34.3 : 91.1 : 13.15 : 13.2. LAY, D. W. **Bob-white populations as affected by woodland management in eastern Texas.** *Bull. Tex. agric. Exp. Sta.* No. 592, 1940. pp. 37.

60 : 97.1 : 12.19. COOPER, W. S. **Man's use and abuse of native vegetation: the lessons of the past and the prospects for the future.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 5–18. [University of Minnesota.]

Man's present land-use pattern in North America has been reached largely by trial and error and it presents many problems which can only be solved on the basis of knowledge of certain natural factors:—(*a*) the life history and particularly the physiology of key species, (*b*) nature and development of communities, (*c*) distribution of communities over the continent. Consideration is given to the knowledge at present available in this regard and to possible future lines of investigation. Problems relating to the treatment of specific types of native vegetation are discussed, both for vegetation that still retains much of its original constitution and for that which has been so abused that it is now apparently useless.

60 : 97.1 : 12.19 : 64. PEARSON, G. A. **What forest trees tell about climate and soil.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 19–31. [Southwestern Forest & Range Exp. Sta.]

Seven broad zones of vegetation and climate are recognized in the southwestern United States, the limits

of each being determined largely by altitude, the altitudinal limits varying in some degree with latitude and with direction and steepness of slope. The zones and their approximate altitudinal limits are: desert, near sea level—3,000 ft.; desert grassland, 3,000–5,000 ft.; woodland, 5,000–7,000 ft.; Pine forest, 7,000–8,500 ft.; Fir forest, 8,500–10,000 ft.; Spruce forest, 10,000–11,500 ft.; alpine zone, above 11,500 ft. Annual and seasonal temperature and precipitation data are given for each zone and the relation of these factors to plant distribution is indicated. The common tree species and growth characteristics of each zone are noted. It is pointed out that trees and certain associated herbaceous plants are often good indicators of the productive capacity of the site on which they are growing.

60 : 97.1 : 12.19 : 64. ZON, R. **Natural vegetation as a key to conservation practices.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 1–3. [Lake States Forest Exp. Sta.]

Mistakes made in early land settlement in the United States were in part due to lack of knowledge of the relation between natural vegetation and environment. In future, plant science can play an important part in efficient land management. Some plant indicators of soil fertility in the Lake States are noted.

60 : 97.1 : 34.21 : 45.11 (54). SAGREIYA, K. P. **Livestock problem *vis-a-vis* grazing, including regulation of grazing in the reserved forests.** *Bull. C. P. For. Dep.* No. 2, (revised ed.) 1940. pp. 57.

An account is given of the livestock grazing problems in the Central Provinces and Berar and a remedy for the present unsatisfactory condition is suggested. The development of forest-grazing regulation is outlined briefly and the results indicated. Mass agitation for increased grazing in forests resulted in a reclassification of the entire reserved forests in 1934, by which the area of 'tree forest', in which incidence of grazing is limited to 2–4 acres per animal to favour the forest, was reduced from 82·3 to 46·1 per cent. and 'scrub forest', in which preservation and improvement of pasture is the primary object of management, was increased from 12·7 to 48·4 per cent.

60 : 97.1 : 56.02 : 11.21 : 09.2. DOUGLASS, A. E. **Dendrochronology and studies in 'cyclics'.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 57–79. [University of Arizona.]

60 : 97.1 : 8 (73). DANA, S. T. **Natural resources and the States.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 161–74. [University of Michigan.]

A discussion of the part that State Governments may play in the conservation of natural resources and particularly of methods by which State participation in the regulation and management of the forests may be increased, including (*a*) public assistance in the fields of forest protection, technical guidance and tax reform; (*b*) social control of the activities of the more backward owners; and (*c*) public ownership.

60.2. *Management of Tree Plantations under Non-forest Conditions*

60.2 : 24.4 : 23.21 (931). YEATES, J. S. **Farm trees and hedges.** *Bull. Massey agric. Coll.* No. 12, 1942. pp. 206 + 2. [Massey Agricultural College, Palmerston North, N.Z.]

A comprehensive guide compiled for the benefit of farmers in New Zealand. It is emphasized that, since New Zealand is possibly one of the windiest of the intensively farmed countries in the Empire, its farmers should have a sound knowledge of shelterbelt growing. The bulletin is divided into three parts: the first deals with general principles of farm silviculture, while the second and third discuss the main farm trees and hedge plants, respectively.

60.3. *Management of Different Classes of Forest*

60.3 : 97.1 (73). MCGOWIN, J. F. **The forest problem can be solved by increased production and use.** In 'Conservation of Renewable Natural Resources', University of Pennsylvania Press, Philadelphia. 1941. pp. 191–200. [Alabama Dept. of Conservation.]

A discussion of the factors affecting sustained-yield management in the United States, particularly in the south. The urgent need of protecting forests from fire is emphasized.

60.31.1 (79) : 66 : 97.1. HORNING, W. H. **Planning sustained yield forest management on the O. & C. Lands.** *J. For.* 40, 1942 (474–6). [U.S. Dept. of the Interior.]

A plan is outlined for the practical management on a sustained-yield basis of an area of 2½ million acres estimated to contain some 50 billion bd. ft. of merchantable saw timber. This land, which extends through the greatest remaining reservoir of virgin forest in the United States, is intermingled with privately owned forest land, and the development of co-operative management units, including both public and private lands, is an important phase of the undertaking.

60.31.2 (73). **Forestry on private timberlands: a pictorial record of what some private timberland owners in the United States are doing to keep their forest lands productive.** *Misc. Publ. U.S. Dep. Agric.* No. 381, 1940. pp. 25.

60.31.2 (73) : 97.2 : 11.6. PRESTON, J. F. **The field for farm forestry in the farm conservation program of the Soil Conservation Service.** *J. For.* 40, 1942 (291–5). [Soil Conservation Service.]

60.31.2 (76.3) : 76. BOND, W. E., and RHODES, R. R. **Forestry as a farm enterprise in Washington Parish, Louisiana.** *Occ. Pap. Sth. For. Exp. Sta.* No. 100, 1941. pp. 23.

60.31.2 (77.6) : 22 : 24 : 32.29.2 : 33 : 07.2. **Forest management by Potlatch Forests, Inc., with special reference to Clearwater County, Idaho.** *J. For.* 40, 1942 (364–70).

A symposium of four papers on forest management by Potlatch Forests, Inc. The papers include 'Prospects and Policies' by C. L. Billings, 'Cutting Practices' by E. C. Rettig, 'Slash Disposal' by J. T. Baggs, and 'The Road Ahead' by E. F. Rapraeger.

The forests of the company, located in northern Idaho, are being cut selectively over a 30-year cutting cycle. Timber is marked before cutting, and age and vigour of stand determine the type of cutting to be used. Three age classes are recognized, young, mature, and decadent. In young stands (up to 140 years) a shelterwood method of cutting is generally used leaving a residual stand sufficient to provide a second cut in 25–30

years. The seed-tree method is applied to mature stands (141–200 years) removing about 70 per cent. of the volume. All merchantable timber available is utilized from decadent stands. The slash is piled in large, compact, well-rounded piles, placed at safe distance from living trees, and usually burned in the autumn. Average annual production of lumber during 1927–40 from one of the three sawmills in operation by the company was 112 million bd. ft. of which 89 per cent. was Western White Pine.

60.31.2 (79.7) : 23.21 : 23.27 : 24.4. NAGLE, J. P., and STEFFEN, E. H. **Trees for Washington farms.** *Pop. Bull. Wash. agric. Exp. Sta.* No. 159, 1940. pp. 48.

A popular bulletin dealing with the selection of species to be planted for different uses and conditions, the preparation of the planting site and the planting and care of trees. Brief descriptions are given of species suitable for farm planting in Washington.

60.31.2 : 12.26–8 : 24.4. MCGRAW, C. F., and DAVIDSON, J. B. **Osage-Orange plantings.** *Soil Conserv.* 7, 1941–42 (303). [Soil Conservation Service.]

Osage-Orange (*Maclura pomifera*) is a valuable species for planting on a farm (1) to protect reforested and wooded areas against wind and livestock, (2) to supply farm wood requirements, particularly posts, fuelwood, and brush barriers, and (3) to provide small wildlife escape coverts.

61 SURVEYING. MAPPING

61.3 (73). GARVER, R. D. **The nation-wide forest survey.** U.S.D.A. Forest Service, Washington, D.C. 1940. pp. 8.

An account of the work in progress.

61.32 (71.1). MOTTISHAW, J. S. **Aerial forest surveys in British Columbia.** *Univ. Wash. For. Cl. Quart.* 15 (3), 1941–42 (18–21). [B.C. Forest Service.]

Brief note on the method of forest survey which is of reconnaissance intensity, the object being to collect basic data for the management of 75 million acres of forests. The area to be surveyed is completely covered by vertical aerial photographs, which, together with data from earlier surveys, are used to compile a base map for use by the field party. All cruise data are transferred to individual photos of the area before the final mapping of forest types is undertaken. The advantages of aerial forest surveys are summarized.

61.32 : 61.4. KELSH, H. T. **The slotted-templet method for controlling maps made from aerial photographs.** *Misc. Publ. U.S. Dep. Agric.* No. 404, 1940. pp. 29. [Soil Conservation Service.]

The method is described in detail together with tests undertaken to ascertain its possible scope. These have shown that the slotted-templet method is a very valuable help in the mapping of country where ground control is exceedingly sparse.

63. ROTATION

63 : 12.25 : 22.88.2. BRITISH COLUMBIA. **Report of the Forest Branch for the year ended December 31st, 1941.** Govt. Printer, Victoria, B.C. 1942. pp. 55.

It has been determined that the optimum rotation for second-growth Douglas Fir in the lower coast region of British Columbia should not be less than 120 years on the better sites and 140 years or more on poorer sites (p. G13).

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

64 : 12.19.2 : 11.4 (71.4). HEIMBURGER, C. C. **Supplement and corrigenda to Silvicultural Research Note No. 66—'Forest-site classification and soil investigation on Lake Edward Forest Experiment Station'.** Dominion Forest Service, Ottawa. 1942. p. 1 + plates.

8. ADMINISTRATION

8 (43.1–5). LAMBERTS, O. Organisation der Forstverwaltung. [Organization of forest administration.] *Forstarchiv* 18, 1942 (49–58). [G.]

The development of the Prussian State Forest Administration since 1815 and its present structure within the framework of the Reich Forest Administration are outlined.

82. LABOUR QUESTIONS

82. MCEWEN, C. W. **Saving men and man-hours through first aid.** *W. Cst. Lumberm.* 69 (5), 1942 (38). [Anaconda Copper Mining Co., Lbr. Dept., Woodworth, Mont.]

Includes notes on a portable first-aid station and on emergency cabinets located at landings, loading points, etc.

82 : 33.1 : 12.26–8. FOX, E. C. **Mesquite wood dermatitis.** *Arch. Dermat. Syphilol.* 44, 1941 (1098–100). B.C.P.A. 1942, A., III (356). P.R.

The dermatitis was caused by sawdust.

82 : 33.36.1 : 33.31. STINGILY, K. O. **A new industrial chemical dermatitis.** *Southern Med. J.* 33, 1940 (1268–72). Chem. Abs. 36 (847–8). P.R.

Sodium tetrachlorophenoxide, used in the lumber industry, is toxic to those who come into contact with it for any length of time. The skin lesions last over a period of years. Their chronicity is probably due to an underlying fungus infection.

9. FOREST POLICY

90. GENERAL PRINCIPLES OF FOREST POLICY

90 (71). **Post-war rehabilitation.** *For. Chron.* 18, 1942 (15–33).

A symposium of papers discussing the place of forests and forestry in post-war rehabilitation in Canada.

90 (71) : 7. HARRISON, J. D. B. **The influence of economics on forest policy.** *For. Chron.* 18, 1942 (34–7).

Under Canadian conditions of forest resources, the decision whether more intensive forest management on a given area is justified must in general be based on sound economic grounds.

91. SOCIAL AND ECONOMIC SIGNIFICANCE OF THE FOREST

91.1. *Rural Preservation. Reserves. National Parks. Plant and Animal Protection*

91.1 : 09.1 (74.7). OSTRANDER, G. N. **The history of the New York Forest Preserve.** *J. For.* 40, 1942 (301–4). [Finch, Pruyn & Co., Inc.]

91.1 : 11.62.11 : 23.3. HAWBECKER, A. C., and BOND, R. M. **Wildlife increased by erosion control practices.** *Soil Conservation* 7, 1941–42 (255–6). [Soil Conservation Service.]

The planting of eroded, sub-marginal land with trees and shrubs was followed by the establishment of quail and other birds on the area.

92. FOREST LAW

92 (54.87) : 97.1 : 99. **Legislative Enactments of Ceylon. The Land Development Ordinance, 1938 Revision.** Govt. Record Office, Colombo. 1940. pp. viii + 42.

92 (71.21). MANITOBA. **Forest Regulations O–I–C No. 1229/33, passed October 6/33 and Amendments.** [1941?]. pp. 26 + 2.

92 (71.21). MANITOBA. **The Forest Act, being Chapter 79 of the Revised Statutes of Manitoba, 1940, including amendments thereto enacted in 1940.** King's Printer, Winnipeg. 1940. pp. 23.

95. FOREST TAXATION

95.1 (73). DEVRIES, W. **Expressing the weight of property tax on forestry.** *J. For.* 40, 1942 (471–3). [Pacific Northwest Forest & Range Exp. Sta.]

An attempt to clarify misunderstandings that arise in property-tax discussions involving (1) measurements of tax burden on forest lands, (2) consistency in illustrative examples, and (3) discrimination between inherent and administrative faults. The author also summarizes inherent effects of the property tax on forest management and how its excess burden on deferred income forests may be removed.

95.1 (74.8) : 94 : 97.1. FORBES, R. D., and BECK, C. W. **Tax delinquency of forest lands in the Anthracite Forest Region of Pennsylvania: a county opportunity and responsibility.** *Anthrac. Surv. Pap. Allegh. For. Exp. Sta.* No. 3, 1941. pp. 16.

95.1 (76.1 : 76.2). CRAIG, R. B. **Taxes on forest property in nine selected counties of Alabama, 1937–40, and in seven selected counties of Mississippi, 1936–40.** *Occ. Pap. Sth. For. Exp. Sta.* No. 99, 1941. pp. 13.

95.1 (79.5 : 79.7). DEVRIES, W., and MCDANIELS, E. H. **Forest taxation in Oregon and Washington.** *W. Cst. Lumberm.* 69 (4), 1942 (32–3). [Pacific Northwest Forest & Range Exp. Sta.]

Three laws have been enacted in these States during the past ten years in an attempt to overcome some of the difficulties met with in applying the property tax, especially to forest property. These are the Forest Fee and Yield Tax Law in Oregon, the Fixed Assessment and Yield Tax Law in Washington, and, most recently, a Deferred Timber Tax Law enacted in Washington in 1941.

96. POLICY REGARDING PROTECTION FOREST

96.3 (729.9) : 97.1 : 60.31.2 : 11 : 62.1. **Deforestation.** *J. Jamaica agric. Soc.* 45, 1941 (460–2). A.P.B.

In order to prevent deforestation and erosion in Antigua a new Forestry Ordinance (No. 7 of 1941) has been enacted and is now in force. According to this enactment, all land in forest as from 11th June, 1941, is deemed a Forest Reserve and passes under the control of a Forestry Board of 5 members appointed by the Governor. No clearing of such land, and no timber cutting or charcoal burning thereon, may take place without permission from the Board. No compensation is payable and there is no option to refuse restrictions. Any private land that ought to be reforested may be declared a Forest Reserve by the Governor in Council, provided that this shall not apply to land under cultivation or grazing without the owner's consent. The Board may carry out any reforestation scheme on such lands with funds provided by the Government, or the owner may carry out the scheme and be reimbursed by the Government. Land taxes may be remitted. It is not intended to interfere with private rights where clearing can do no harm; reasonable requests for clearing or felling will be granted; and in the event of the Board's refusing permits the aggrieved person may appeal to the Governor in Council. Nothing in the Ordinance prevents the cutting of trees on cultivated land or on recognizable pasture land.

97. POLICY REGARDING THE RELATION OF THE FOREST TO AGRICULTURE, PASTURE, AND INDUSTRY

97.1 (73) : 92. **State legislation for better land use: A special report by an Interbureau Committee of the United States Department of Agriculture.** Supt. of Documents, Washington, D.C. 1941. pp. 122.

97.1 (77.4) : 60. ANDREWS, H. J., and BROMLEY, W. S. **Trends in land use in northern Michigan: a study of Alpena, Antrim, Ogemaw, and Roscommon Counties.** The Charles Lathrop Pack Forestry Foundation, Washington, D.C. 1941. pp. 45. [University of Michigan.]

The most striking change in forest conditions between 1923–24 and 1939 is the reduction in area of stands of 0–3 in. d.b.h. and the increase in area of those 3–9 in. d.b.h. In particular, the increase from 35,000 to 155,000 acres of stands containing 6- to 9-in. trees gives promise of early merchantability of considerable areas for timber. The merchantable supplies should support new wood-using industries which will add much to the prosperity of the region, especially if new uses can be developed for the large quantity of low-grade material for which the present demand is poor.

97.1 : 60 (75). **Conservation of renewable natural resources: some fundamental aspects of the problem.** University of Pennsylvania Press, Philadelphia. 1941. pp. 200.

A series of conference papers dealing with three main aspects of the problem: (*a*) the natural vegetation of the United States as a guide to current agricultural and forestry practice, (*b*) climatic cycles in relation to the theory and practice of conservation, and (*c*) the administrative task of conservation—private and public. Individual papers concerned with forestry problems are abstracted separately.

97.1 : 60.31.2 : 94.3 (73). GILLETT, C. A. **A possible solution to the State and private forest land problem.** *J. For.* 40, 1942 (457–70).

With Recommendation No. 1 of the Joint Congressional Committee on Forestry as a basis, a plan is presented for the development of an organization in any or all States to handle the private forest land problem in all its aspects.

97.1 : 60.31.2 : 94.3 (73). NELSON, A. Z. **The consumer's stake in the regulation of forest land.** *J. For.* 40, 1942 (379–83). [U.S. Forest Service.]

The destructive exploitation of the forests of the United States, which in the past has caused serious maladjustments in consumer and national economy, may increase with the present increased demand for timber. In consideration of this demand and of the post-war national and international timber requirements, which may have to be supplied largely from the resources of the Western Hemisphere, and of the many other direct and indirect benefits of forests, it is suggested that a wider adoption of some regulation of cutting practices on forest land is urgently needed.

97.1 : 60.31.2 : 94.3 (73). ROGERS, N. S. **Who shall regulate our forests?** *J. For.* 40, 1942 (384–7). [State Forester, Salem, Ore.]

A discussion of the development of State regulation of forest land in Oregon and in particular of the objectives and application of the Oregon Forest Conservation-Act of 1941.

97.1 : 60.31.2 : 94.3 (73). STODDARD, C. H. **A pattern for public regulation of private forests.** *J. For.* 40, 1942 (371–6). [Bureau of Agricultural Economics.]

97.1 : 60.31.2 : 94.3 : 76 (74.9). MOORE, E. B. **Developing private forestry in New Jersey.** *J. For.* 40, 1942 (388–92). [New Jersey Department of Conservation & Development, Trenton.]

In order to improve cutting practices on the more productive forest sites under private ownership, the New Jersey Department of Conservation and Development is offering an intensive type of assistance in woods management. This includes a 100-per-cent. cruise of trees 6 in. and more in diameter on areas not greater than 75 acres, the selection and marking of trees to be cut, the computation of the volume of marked trees and the distribution to lumber operators of prospectus sheets describing the marked timber. Case histories illustrate the type and value of the work being done.

NOTES FROM THE DAILY AND THE NON-TECHNICAL PRESS

References: 1. *Chicago Tribune*, Chicago. 2. *Dagens Nyheter*, Stockholm. 3. *Dallas Morning News*, Dallas. 4. *Danziger Vorposten*, Danzig. 5. *Deutsche Zeitung im Ostland*, Riga. 6. *Domestic Commerce*, Washington. 7. *Foreign Commerce Weekly*, Washington. 8. *Los Angeles Times*, Los Angeles. 9. *Monetary Times of Canada*, Toronto. 10. *Neue Züricher Zeitung*, Zurich. 11. *New York Herald Tribune*, New York. 12. *New York Times*, New York. 13. *New York World Telegram*, New York. 14. *Press Releases*, Washington. 15. *Report of the Royal Bank of Canada*, Montreal. 16. *Revaler Zeitung*, Tallinn. 17. *Vancouver Sun*, Vancouver. 18. *Victory*, Washington. 19. *Wall Street Journal*, New York. The numbers in brackets indicate the reference number and the date of publication of the newspapers and journals to which the annotations refer.

Brazil. South America's largest pulp and paper mill is to start production in March, 1943. Its cost will be about $3.3 million and its ultimate capacity 160 tons a day (**7**; 6.6.42).

Canada. Mr. A. S. Nicholson, Controller of Timber, gave details of Canada's timber industry in 1941. Production of timber amounted to approximately 5,087 million bd. ft., of which nearly 50 per cent. came from British Columbia. Figures for the other Provinces, in millions of bd. ft., were: Quebec, 940; Ontario, 557; Nova Scotia, 403; New Brunswick, 375; Alberta, 251; Saskatchewan, 121; and Manitoba, 104 (**17**; 17.2.42).

Since the beginning of the war the importance of Canada's pulp and paper industry to the war effort has steadily increased. At the same time considerable improvement has taken place within the industry. Preliminary estimates place the total value of pulp and paper exports during 1941 at approximately $260 million as compared with $232 million in 1940 and $155 million in 1939. As the larger part of these exports was consigned to the U.S.A. and other countries outside the 'sterling area' a valuable addition to Canada's foreign exchange resources resulted.

Canada's newsprint production in 1941 was 3,425,865 tons, practically unchanged from that of 1940, but a considerable increase over the 1939 figure of 2,869,266 tons. The loss to many countries of Scandinavian sources of supply resulted in some increase in Canadian sales, but the net gain was not very great. Canada's war-time overseas trade in pulp and paper products has decreased. In 1941 overseas shipments amounted to 487,897 tons as compared with 657,588 tons in 1940 and 477,594 tons in 1939. Exports to Latin America improved during the year, but it is likely that they will be more than offset by the loss of markets in the Orient, and reduced shipments to Australia, New Zealand, South Africa, and possibly Great Britain (**15**; March, 1942).

A huge grain-storage depot constructed entirely of timber has just been completed at Fort William. The use of Teco timber connectors is said to make the structure as strong as one of steel (**9**; 13.6.42).

Estonia. 'Bolshevik fury of destruction' and the consequences of the war are blamed for the fact that timber transport is now practically confined to floating. Some 100,000 cu. m. of timber from State forests are to be floated during the current season, and about 1,500 men are to be employed in this work, which it is estimated will require 22,000 man-days (**5**; 12.4.42).

All lorries and agricultural tractors are to be converted to producer-gas operation. Orders for stationary plants have been booked by many factories. Trains driven by producer gas have been introduced, and a tramcar driven by wood gas is plying between Tallinn and its suburb Koppli. It is intended to install wood-gas producers on many more trams in the Tallinn service. Several mills have started manufacturing producer fuelwood and a number of fuelling stations has been opened. Large consignments of producer-gas equipment have arrived from Germany, Sweden, and other countries, and more are expected. Free courses have been started for training agricultural and other workmen in the use of producer-gas-driven tractors. [*Note.*—The Estonian shale-oil industry is supplying the Wehrmacht exclusively.] (**2**; 17.7.42, **5**; 21.3.42 and 21.6.42, and **16**; 14.7.42).

Germany and Poland. An article in the *Danziger Vorposten* (**4**; 5.6.42) describes the large and almost virgin forest area of Bialowieza. The whole region, embracing some 260,000 ha., has been placed under the care of head forester Ulrich Scherping. According to the writer, isolated villages have been removed from the area in order to prevent the settling of further inhabitants, with consequent damage to the forests through grazing, &c.

Latvia. As in Estonia, floating of timber is expected to assume unusual importance this season. Work is concentrated along the Dvina, the Windau, and the two Aa rivers. Large quantities of timber are stacked on the shore and are to be shipped or rafted by sea to sawmills, chiefly in Riga and Windau. At present 13 mills with a total of 48 frame saws are at work, in addition to 9 plywood factories. It is thought that the production of the sawmills and plywood factories can be increased without much expenditure (**5**; 16.4.42).

Sweden. The Swedish State Fuel Commission has arranged for the cutting of 50 million cu. m. of wood in the year commencing 1st July, 1942. This will exceed annual growth by about 2½ million cu. m. (**7**; 20.6.42).

An agreement was concluded between the Swedish wood-processing industries and German negotiators for the supply of timber, cellulose, and paper during the first six months of 1942 [cf. *For. Abs.* 4 (69)]. Approximately Kr.90 million were involved, half of which was to be paid in cash through the German–Swedish clearing, while for the remainder an eighteen months' credit would be granted by Swedish exporters. [Exchange at par, 18.159 Kr. =£1]. They would be able to fall back upon the guarantee of the Swedish Exports Credit Association for 70 per cent. of the credit, their own risk thus amounting to merely 15 per cent. of the purchase price. [*Note.*—Originally Swedish exporters were to bear 20 per cent. of the risk, but refused to do so, and the Swedish Exports Credit Association was forced to increase their guarantee. Furthermore, the German buyers had to concede certain price increases in respect of artificial silk cellulose and paper (15 per cent.) and sulphate cellulose (40 per cent.); these price increases have meanwhile in some cases been neutralized by the increase in costs.] Quantitatively these contracts are not very considerable as compared with previous years. But they are important owing to the fact that Germany is to-day the biggest foreign buyer of Swedish processed wood products. The contracts for the first six months cover about 50,000 tons of artificial silk cellulose, 40,000 tons of sulphate cellulose and 35,000 tons of kraft paper (Kraftspinnpapier). Unbleached sulphite cellulose did not figure in the contract, as Sweden needs it for her own production of fodder cellulose.

A good deal of concern is felt by the wood-processing industry about insufficient supplies of raw material. The authorities calculate that the total demand for wood during the current year will exceed that of 1941 by 20 per cent. and that it will be difficult to satisfy. There are, moreover, indications that the supply of timber will not be sufficient for the demands of the cellulose industry. Latest estimates place the total wood requirements of the country for 1942 at about 57 million cu. m., of which 15 million are for the paper and cellulose industry, 7·8 million for sawmills, 27 million for fuel, 0·4 million for sleepers, matches, &c., and 7 million for forest owners' own requirements. It is pointed out that in three years of increased fellings in central and southern Sweden all the wood has been cut that could be exploited without bringing about a depreciation of the forests.

An Institute for the investigation of the uses of wood has been founded by the Swedish State in collaboration with the leading organizations of wood-processing industries, the State contributing Kr.420,000 per annum and a single grant of Kr.1,700,000. It is stated that the Institute has already made valuable contributions to the problem of the use of the by-products of sulphite cellulose, alcohol in particular. The cellulose industry produces at present about 60,000 tons of fodder cellulose per month, and a plant for the production of 30,000 tons of wood sugar from cellulose has been planned (**10**; 21.4.42 and 4.5.42).

United States. Recently, wood has been the only major raw material of which supplies appeared to be more or less unlimited in the United States. As a result, it has been largely used as a substitute for metals, all of which were subject to restrictions, and particularly for iron and steel. Many types of consumers' goods have been made from wood; barrels, wooden boxes and cases have taken the place of other types of container; new railroad freight cars have been made of wood, and the possibility of expanding the output of wooden ships has aroused interest. Wood has been used instead of steel for airplane hangars, warehouses, and other buildings, and the War Production Board (WPB) has stipulated that, wherever possible, wood-frame construction should be used instead of steel in new buildings. In March WPB authorized manufacturers to produce 72,000 tons of nails a month for the next four months, because lumber was replacing steel in wartime building; average monthly output of nails in 1941 was 65,000 tons. Although non-essential building has been prohibited, large quantities of structural timber will still be needed for military construction, for housing war workers, and for new factories, and this was expected to offset any decline in civilian requirements. In addition, there has been a heavy demand for such wood products as charcoal, naval stores, wood pulp, and cellulose (**1**; 20.4.42, **8**; 8.5.42, **12**; 22.3.42 and 11.4.42, **14**; 30.3.42 and 30.5.42, and **19**; 12.2.42, 3.4.42, 9.4.42, and 25.4.42).

Direct and indirect war requirements and essential civilian needs absorbed over 75 per cent. of timber production in 1941. In 1942 it was expected that 30 billion bd. ft. would be needed for these purposes [cf. *For. Abs.* 4 (69)]. Total output of timber for 1942 has been officially forecast as 35 billion bd. ft., but the trade expected it to be more (**6**; 5.3.42 and **13**; 9.5.42).

Consumption of timber has been exceptionally heavy ever since the beginning of the defence programme.

In the autumn of 1941 it was thought that the peak had been reached, but the attack on Pearl Harbour was followed by a further big increase in the demand for timber. During the first four months of 1942, total orders placed with sawmills were 10 per cent. greater than in the corresponding period of 1941 and on 18th April the industry had an accumulation of orders equal to 56 per cent. of mill stocks. Every effort has been made to increase output of all types, but timber producers have found difficulty in adjusting production schedules to demand. Equipment and supplies needed in the woods and mills have been very short and the drafting of men into the Armed Forces and the diversion of experienced workers to other war industries has lowered the supply and productivity of labour. As a result, inventories have been seriously depleted and were below satisfactory levels. It was expected that, for the time being at least, timber would be difficult to obtain as quickly as it was needed and that it might even become a critical material (**6**; 27.11.41, 5.3.42 and 14.5.42).

The West Coast is the foremost timber producing district in the United States and pressure on producers in this area seems to have been particularly heavy. At the end of April unfilled orders were 1,029,124,000 bd. ft., greater than ever before. Owing to shortages of labour and bad weather in the spring, the output on the Coast has recently fallen below that for the corresponding period of last year. On 18th June, Mr. Nelson, Chairman of WPB, announced that, in order to facilitate all-out timber production, he was designating Mr. Frederick Brundage as Western Log and Lumber Administrator of the Lumber and Products Branch of WPB and that Mr. Brundage would have full powers to carry out such action as might be necessary to obtain the qualities and quantities of timber required for the war programme. A board representing all branches of the western lumber industry was to be appointed to assist him. Workers in the woods and sawmills on the Coast would be asked to forego their holidays this year and owners and operators would be requested to cut the best and most accessible timber in the region, to use existing equipment to the fullest possible extent and to employ water and rail transport instead of lorries wherever possible. It was suggested that Governors of Pacific Coast States should be asked to review State legislation that might restrict timber production. Selective Service Boards were to consider the temporary deferment of certain especially skilled men who were required by the industry. A new method of granting priority assistance to the industry was being worked out, in order to reduce loss of time resulting from lack of material for repairs and maintenance (**14**; 18.6.42 and **19**; 14.5.42).

In 1941 27·5 billion bd. ft. of softwood timber were used in general construction, defence housing, railroad operations and maintenance, and for boxes and crates. On 5th May, 1942, Mr. Nelson said that the shortage of softwood timber for the building of cantonments and war plants was critical and he appealed to logging and sawmill operators to bring production of softwood construction timber to a maximum. On 13th May, all wholesale sales and deliveries of this type of timber were stopped for sixty days, except to meet the needs of the Services and Maritime Commission. It was hoped that stocks accumulated in mill yards during this time would be large enough to carry over the period of heavy demand, but a general allocation order was regarded as a possibility. Stocks in retail yards were estimated at about 7 billion bd. ft. and it was thought that this would be enough to meet essential civilian demands during the sixty days' period. But it has been necessary for WPB to authorize special shipments of timber for more than 100,000 vitally-needed-defence housing units, work on which was held up by shortages of timber resulting from the order (**6**; 27.11.41, **14**; 5.5.42, 13.5.42, and 3.6.42, **18**; 19.5.42, and **19**; 9.5.42, 14.5.42, 22.5.42, and 23.5.42).

In March the use of Teak was limited to ship decking for the Navy and to other Service requirements (**12**; 6.3.42). In May severe restrictions were placed on Mahogany suitable for combat watercraft and for aircraft and other military purposes. Lack of shipping space prevented the importation of Mahogany from Africa, normally the chief source of supply, and the United States had therefore become almost entirely dependent on Central American supplies. Future imports were to be restricted to grades of Mahogany needed for military uses, chiefly for plywood for aircraft and boats and for patterns in industrial plants. Shipping space certificates for Mahogany logs from Central America were abolished in order to facilitate their importation; control of imports was still exercised through shipping priority ratings and the allocation of shipping space (**14**; 26.5.42 and 29.5.42).

Plywood has proved to be a popular substitute material, and has been used in airplanes, pontoon bridges and small boats and in many ways by the building industry, particularly for emergency construction. The so-called plastic airplanes are made of plywood impregnated with synthetic resins and glues of various types. This material can be moulded into shape so that riveting is unnecessary. It is said to be stronger than steel and to be highly resistant to oil, water and fire; bullet holes in it can be more easily repaired than those in metal. This material has been used in making trainer planes and it has been proposed to use it in cargo transport planes. Three furniture plants have already been making airplane parts out of plywood and eventually twelve or more companies are expected to produce wooden airplanes and sub-assemblies. Demand for plywood is therefore expected to grow.

Production of plywood in 1941 averaged 150 million sq. ft. a month as compared with 90 million sq. ft. a month in 1940, and the increase in output was said to be continuing. But every thousand sq. ft. of 3-ply plywood takes forty pounds of glue. This is of two types—moisture-resistant made from protein adhesives, and waterproof made from phenol and formaldehyde. The latter type was in increasing demand because of the new uses for plywood, but the necessary chemicals were severely restricted owing to war production needs. There has also been some difficulty lately in obtaining suitable Douglas Fir peelable logs, which originally were used almost entirely for plywood but are now needed for other purposes. Various methods of increasing production and economizing in the use of plywood have been discussed between WPB and plywood manufacturers, and the number of sizes of moisture-resistant Douglas Fir plywood has been reduced by order of WPB from about 4,300 to about 300; this was expected to increase output by about 20 million sq. ft. a month (**1**; 9.5.42, **3**; 20.4.42, **11**; 6.4.42 and 21.4.42, **12**; 6.4.42, **13**; 9.5.42, **14**; 14.5.42 and 15.6.42, **18**; 12.5.42, and **19**; 1.5.42 and 12.5.42).

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